TECHNOLOGY DEPT.

PUBLIC LIBRARY
JUL 2 - 1951
DETROIT

The Chemical Age

VOL LXIV 16 JUNE 1951 No 1666

For over 40 years!

AGITATORS
CLASSIFIERS
FILTERS
LIME SLAKERS
SANDWASHERS
THICKENERS

The foundations laid by

DORR & OLIVER

in the treatment of liquid/solid suspensions have been assisting

NUMEROUS PRODUCERS of

Alum, Alumina, Caustic Soda, Cement, China Clay, Flue Dust, Glass Sand, Pigments, Barytes Chemicals; Pulp and Paper, Fertilizers, Petroleum, Sugar and many other materials.

At our laboratories we have complete facilities for test work in this field, as well as working models for demonstration purposes.

Why not Submit your Problems to us?

DORR-OLIVER CO. LTD.

HOUSE · WILTON ROAD · LONDON · S.W.1.

CRUICKSHANK'S

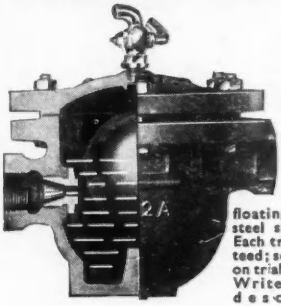
for

COPPER ACETATE
COPPER ACETO-ARSENITE
COPPER CARBONATE
COPPER CHLORIDE
COPPER FLUOBORATE
COPPER NITRATE
COPPER OXIDE
COPPER OXYCHLORIDE
COPPER SILICOFLUORIDE

R. CRUICKSHANK, LTD.

Camden Street, Birmingham, 1
Telephone: B'ham Central 8553 (6 lines)
Grams & Cables: Cruickshank Birmingham.

"Simplicity"
STEAM TRAPS

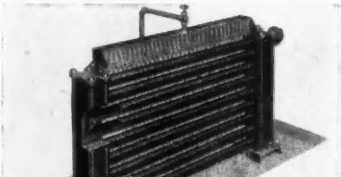


cannot jam or blow steam. Unique in design, foolproof in operation. "Simplicity" Steam Traps have only one moving part—a free floating stainless steel sphere. Each trap is guaranteed; send for a trap on trial. Write for fully descriptive pamphlet.

Agents and Stockists in many countries, the names of whom we will gladly send on application.

THE
KEY ENGINEERING CO., LTD.
4 QUEEN VICTORIA STREET, LONDON, E.C.4
and TRAFFORD PARK, MANCHESTER.
Telephone: CITY 1185/6. TRAFFORD PARK 1903.

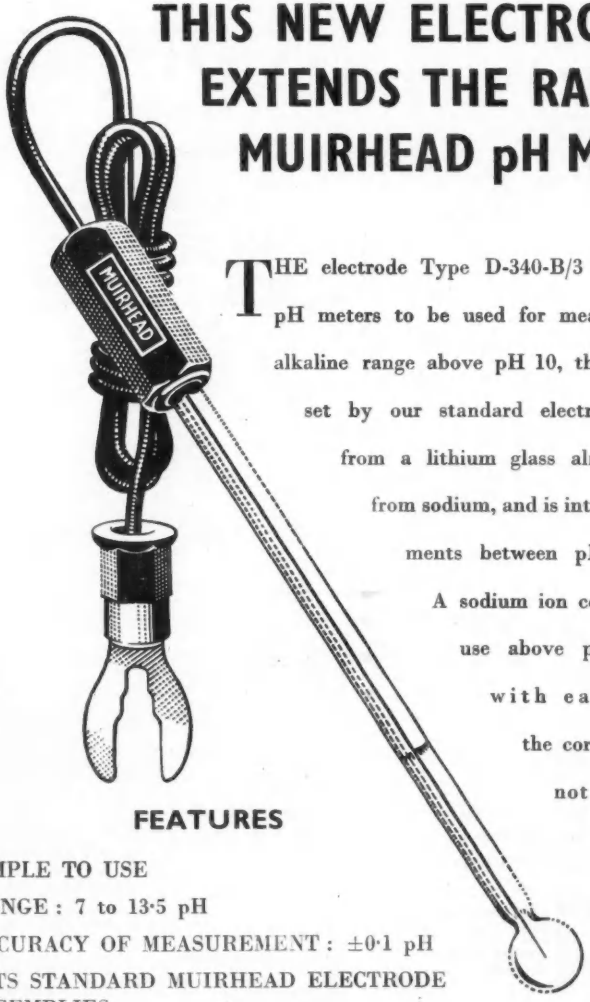
KARBATE
TRADE MARK
SECTIONAL CASCADE COOLERS



This cooler is made of four standard parts, in any of five pipe sizes—viz., 1", 1½", 2", 3" and 4". Prefabricated sections carried in stock for simple assembly to meet capacity requirements. Nine foot long single pipe sections are stacked to form a series flow vertical bank. Approximately 120 sq. ft. external surface area is available in all five sizes for 6 ft. high cooler.

CONSULT—
BRITISH ACHESON ELECTRODES LTD
GRANGE MILL LANE, WINCOBANK, SHEFFIELD
Telephone: Rotherham 4836 (3 lines) *Telegrams:* Electrodes, Sheffield.

THIS NEW ELECTRODE EXTENDS THE RANGE OF MUIRHEAD pH METERS



THE electrode Type D-340-B/3 enables Muirhead pH meters to be used for measurements in the alkaline range above pH 10, the limit previously set by our standard electrode. It is made from a lithium glass almost entirely free from sodium, and is intended for measurements between pH 7 and pH 13·5. A sodium ion correction curve for use above pH 12 is supplied with each electrode; the correction factor does not exceed 0·3 pH.

FEATURES

SIMPLE TO USE
RANGE : 7 to 13·5 pH
ACCURACY OF MEASUREMENT : ±0·1 pH
FITS STANDARD MUIRHEAD ELECTRODE ASSEMBLIES

MUIRHEAD & Co., LTD.
PRECISION ELECTRICAL INSTRUMENT MAKERS
BECKENHAM · KENT · ENGLAND
Phone: BEC 0041 Telegrams & Cables: MUIRHEADS ELMERS-END

PRECISION MUIRHEAD ELECTRICAL INSTRUMENTS

35C

A

Safety First

You need this "EVERTRUSTY" GLOVE BOOKLET

This " EVERTRUSTY " Glove Booklet illustrates and describes a wide selection of our range of " EVERTRUSTY " industry gloves, gauntlets and mitts in leather, cotton, molecloth, asbestos, rubber and P.V.C. plastic materials. It makes the selection of the right glove for the job a matter of ease and certainty.

The coupon below will bring you this booklet free, together with its companion booklets dealing with goggles and respirators and protective clothing.

WALLACH BROS. Ltd

THIS COUPON

pinned to your letterhead and posted to **WALLACH BROS. LTD.**, 49, Tabernacle Street, London, E.C.2, will bring you illustrated Booklets No. 2 showing full range of " EVERTRUSTY " devices.

SAFETY FIRST

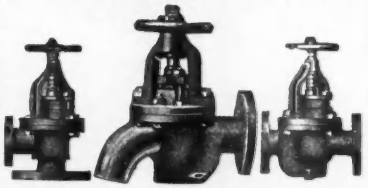
THE "OLDBURY" PATENT CARBOY DISCHARGER

will empty and elevate up to 50 feet the contents of any carboy, bottle or vessel, and complies with all the conditions of the Factory Act of 1937.

KESTNER'S

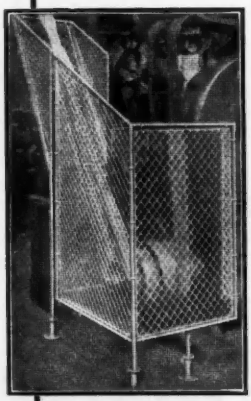
5, Grosvenor Gardens, Westminster, London, S.W.

YOU CANNOT BETTER HAUGHTON'S REGULUS ACID VALVES FOR ACIDS AND ACID LIQUORS



HAUGHTON'S METALLIC CO., LTD.
80, ST. MARY-AT-HILL, LONDON, E.C.3.

POTTER'S
Machinery Guards



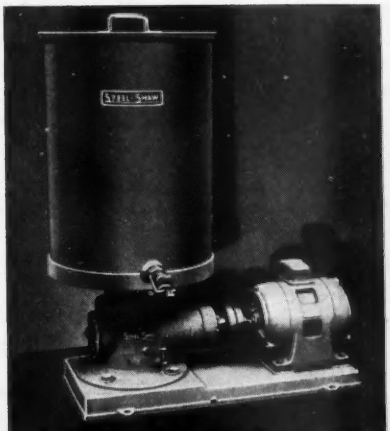
● DESIGNED FOR SAFETY

● BUILT FOR SERVICE

Potter's guards are installed in works throughout the country and are distinguishable by their sound construction, good fitting and many exclusive features.

F.W. POTTER & SOAR LTD.

PHIPP STREET, LONDON, E.C.2
Telephones: Bishopsgate 2177 (3 lines)



HIGH SPEED MIXER

Designed for mixing cellulose, distemper, emulsions, enamels, inks, lubricants, oils, and similar liquids.

STEELE & COWLISHAW LTD.

Engineers (Dept 12) Head Office and Works: **Cooper Street, Hanley, Stoke-on-Trent, Eng.**
London Office: **329 High Holborn. W.C.1. Tel. Hol. 6023**

INDEX TO ADVERTISERS IN THIS ISSUE

	Page
Alcock (Peroxide), Ltd.	ix
Bamag, Ltd.	935
British Acheson Electrodes, Ltd.	Cover ii
British Iron & Steel Federation	v
Brough, E. A. & Co., Ltd.	viii
Chemapol, Ltd.	iii
Classified Advertisements	940, xi & xii
Cole & Wilson, Ltd.	xii
Cruickshank, R., Ltd.	Cover ii
Cygnet Joinery, Ltd.	vi
Dorr-Oliver Co., Ltd.	Front Cover
Farwig, J. F. & Co., Ltd.	xii
Gas Council, The	vii
Geigy, Ltd.	iv
General Chemical & Pharmaceutical Co., Ltd.	Cover iii
Guest Industrials, Ltd.	xii
Haughtons Metallic, Co., Ltd.	ii
International Pulverisers, Ltd.	Cover iii
Kestner Evaporator & Engineering Co., Ltd.	ii, iv & xiv
Key Engineering Co., Ltd., (The)	Cover ii
Laporte Chemicals, Ltd.	vi
Leigh & Sons Metal Works	xiv
Lennox Foundry Co., Ltd.	xiv
Lord, John L.	Cover iv
Metropolitan-Vickers Electrical Co. Ltd.	Cover iv
Mirrlees-Watson Co., Ltd., (The)	ix
Mitchell, L. A., Ltd.	939
Muirhead & Co., Ltd.	i
Potter, F. W. & Soar, Ltd.	ii
Power-Gas Corporation Ltd., (The)	937
Robinson Brothers, Ltd.	xiv
Siebe, Gorman & Co., Ltd.	xiii
Simon, Richard & Sons, Ltd.	Cover iii
Steel, J. M. & Co., Ltd	939
Steele & Cowlishaw, Ltd.	ii
Stewart & Gray, Ltd.	viii
Wallach Bros., Ltd.	ii
Ward, Thos. W., Ltd.	x
Watford Chemical Co., Ltd., (The)	xiv
Wilkinson, James & Son, Ltd.	xiii
Worcester Royal Porcelain Co., Ltd., (The)	xiv

CHEMAPOL

Ltd,
Company for the Import and Export of Chemical Products and Raw Materials

PRAGUE II, PANSKA 9
CZECHOSLOVAKIA

Cables :
Chemapol Praha
Telephone :
279-44/47

Teleprinter :
Praha 286 Chemapol

Exports of Czechoslovak :

Ammonium and Sodium Bicarbonate
Charcoal/Hardwood and Medicinal/
Citric Acid and Citrates
Formic Acid
Lactic Acid
Cresylic Acid
Crude Montan Wax Bohemia brand
Lacquers and Enamels
Bleaching Earth
Textile Auxiliary Products
Potash Chrome Alum
Ultramarine Blue
Rongalite
Cosmetics and Candles
Pharmaceuticals
Saccharine PAGODA brand
and a wide range of other chemicals.

CYANACETIC

AND

MALONIC

ESTERS

We manufacture these valuable organic intermediates in commercial quantities and shall be pleased to receive your esteemed enquiries

PHARMACEUTICAL LABORATORIES GEIGY LTD., MANCHESTER, 3

934-FC.1B.

AXIAL-FLOW ACID FANS

AN ENTIRELY **NEW** ADDITION TO THE WELL-KNOWN RANGE OF **KESTNER FANS**

DESIGNED ON ADVANCED AERODYNAMIC PRINCIPLES. ←

BUILT ENTIRELY OF CHEMICALLY RESISTANT MATERIALS ←

These fans will ensure trouble-free working with high efficiency when used for draughting highly corrosive gases and fumes, including:—

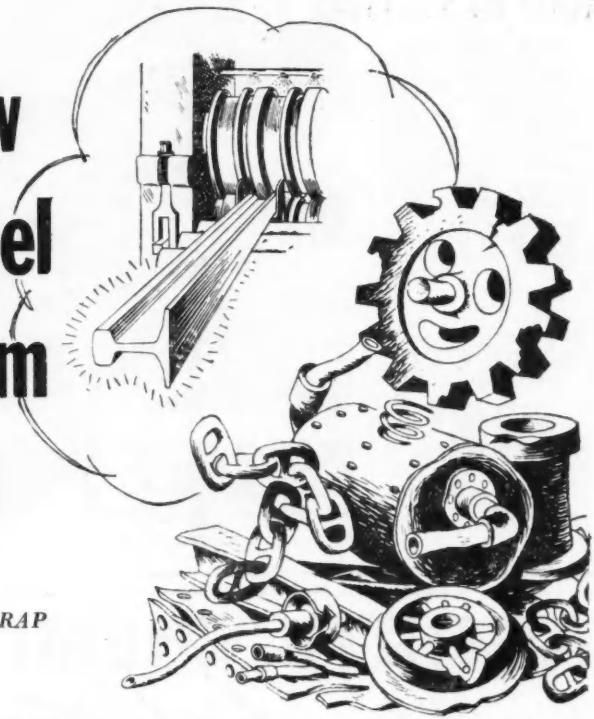
SULPHUR DIOXIDE NITROUS AND SULPHUR TRIOXIDE NITRIC OXIDE CHLORINE AND HYDROCHLORIC ACID

Kestner's

CHEMICAL ENGINEERS

5 Grosvenor Gardens . . . London, S.W.1

New Steel from old



says
JACK SCRAP

Every ton of iron and steel scrap lying around in odd corners of your premises may make a ton of new steel.

Industry needs that steel, agriculture needs it, the nation needs it. Find the scrap, round it up, turn it in. It's essential raw material we can't afford to waste.

WANTED
from the
CHEMICAL INDUSTRY

Broken machinery, boxes and tools and *every kind* of general and process scrap and obsolete plant.

Scrap Merchants everywhere will gladly help with dismantling and collection

SPEED THE SCRAP SPEED THE STEEL

Issued for the STEEL SCRAP DRIVE by the British Iron and Steel Federation, Steel House, Tothill Street, London, S.W.1

T.6

ACID-RESISTING BENCHES

A recent installation of "CYGNET" Laboratory Furniture and Fittings for a large industrial contract.

"CYGNET" Benches Racks, Fume Cupboards, shelving and other laboratory fixtures are made in a large range of standard units or to specification. Complete installations for Industrial, School and College Laboratories at keen prices.

FESTIVAL OF BRITAIN 1951 see our Exhibit in the POWER AND PRODUCTION BUILDING South Bank S.B4 Stand G505 Chemical Section

THE MARK OF THE CRAFTSMAN

ΦB3

CYGNET *Laboratory Furniture*

CYGNET JOINERY LTD., HIGHER SWAN LANE, BOLTON
Bolton 5576/7

LAPORTE CHEMICALS

for Industry

HYDROGEN PEROXIDE

PEROXYGEN COMPOUNDS including: Sodium Percarbonate
Sodium Perborate • Urea Hydrogen Peroxide • Persulphates
Benzoyl Peroxide and other Organic Peroxides

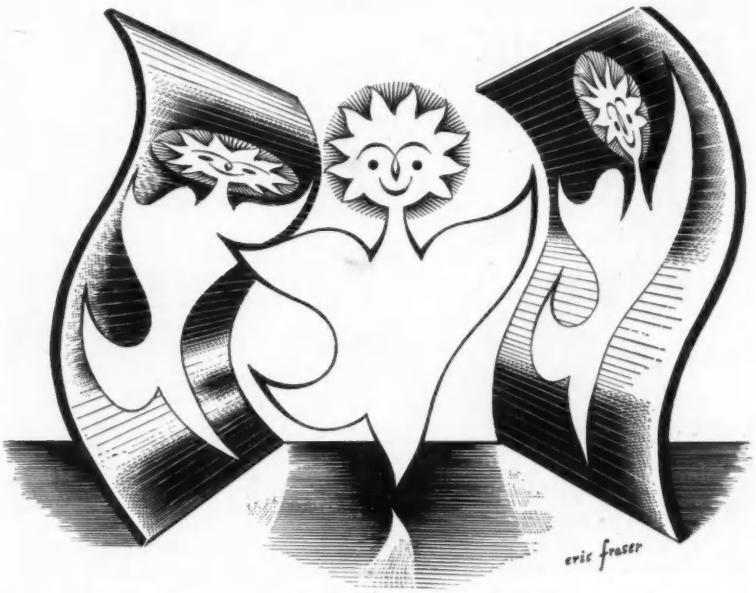
BARIUM COMPOUNDS

including: Blanc Fixe • Barium Carbonate Precipitated
Barium Chloride • Barium Hydrate

Sodium Sulphide • Sulphated Fatty Alcohols
Sodium Metasilicate • Detergents

LAPORTE

LAPORTE CHEMICALS LTD., LUTON.
Telephone: Luton 4390 Telegrams: Laporte Luton.



'FLEXIBLE' IS MY MIDDLE NAME! says Mr. Therm

The gas and gas-heated equipment that Mr. Therm brings in his train are amazingly flexible in their applications to all sorts of heating problems. What other fuel but gas could give you a tiny—but steady—pin-point of flame or full heat the instant you want it? And gas can be controlled at the flick of a finger—or can be completely automatic if required. It needs no storage space, is smokeless and ash-free, and works unfailingly for you with remarkable efficiency. No wonder Mr. Therm is to be found hard at work in so many industries!

Mr. Therm is in the pink

. . . and in a lot of other colours, too! He's got the job of heating the battery of reaction vessels—each of 220 gallons capacity—used in the production of aniline dye at the works of Williams (Hounslow) Ltd. Town gas is used throughout for heating. The specially designed internally insulated housings hold cast-iron pans which are enamelled inside, and fitted with belt-driven agitating mechanism.

MR. THERM BURNS TO SERVE YOU THE GAS COUNCIL • 1 GROSVENOR PLACE • S W 1

ESCOL

THE SYMBOL OF SERVICE AND QUALITY

Vitreous Enamels

Vitreous Enamelling

REFRACTORY COATINGS ON METALS

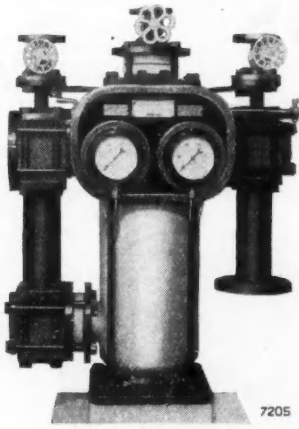
Telephone:
MITcham 1634 (5 lines).
Telegrams:
Escol, Toot, London.

STEWART & GRAY LTD.,
Paisley Works, Swains Road,
Tooting Junction, S.W.17.

Mirrlees'

A Special Steam Ejector Air Pump

Designed for the production and maintenance of Vacuum, and developed to meet the needs of a section of the Chemical Industry.



7205

NO METAL PARTS
IN CONTACT WITH
CORROSIVE GASES

COMPRESSION STAGES OF CARBON.
CONDENSER OF PORCELAIN.

MIRRLEES WATSON
COMPANY LIMITED
SCOTLAND ST GLASGOW

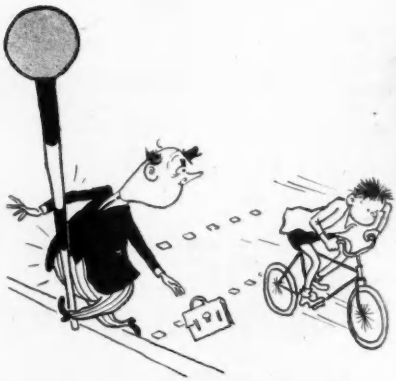
FOR
ALL CLASSES
OF DETERGENT
AND BLEACHING
OPERATIONS

SODIUM METASILICATE
SODIUM SESQUISILICATE
SODIUM ORTHOSILICATE
HYDROGEN PEROXIDE
(ALL STRENGTHS)

SYNTHETIC AND
ALL-PURPOSE
DETERGENT COMPOUNDS

SEND PARTICULARS OF
YOUR DETERGENT AND
BLEACHING PROBLEMS TO

ALCOCK (PEROXIDE) **LTD**
LUTON - BEDS
Telephone : LUTON 4900 (3 lines)
Telegrams : Peroxide, Luton



whenever you encounter a BELISHA BEACON..

TWW

RAIL DEPARTMENT SERVICE includes :— FISHPLATES . BOLTS SPIKES . COACHSCREWS FERRULES . DOGSPIKES CHAIRS . KEYS SLEEPERS . CROSSING TIMBERS . SWITCHES CROSSINGS . TURNOUTS WHEELS . AXLES . BOGIES TIPWAGONS . PORTABLE RAILWAY . TURN-TABLES . BUFFER STOPS RAMPS

remember **WARDS** for **CROSSINGS**

There are crossings and *crossings*. We at WARDS are concerned with the railway variety, and have no more than a nodding acquaintance with individuals connected with other types of crossing—Mr. Belisha, for example, or the stewards on the Dover-Calais steamers.

The crossings we are familiar with are usually common or obtuse; and perhaps because of these very human characteristics we thoroughly understand them. Whenever, therefore, you have any problems in connection with the planning, construction or maintenance of railway sidings WARDS really can be of service.

The Railway Siding Consultants and Contractors

THOS W. WARD LTD
ALBION WORKS · SHEFFIELD
TELEPHONE 26311 (20 LINES) · TELEGRAMS 'FORWARD' SHEFFIELD
LONDON OFFICE: BRETTENHAM HOUSE · LANCASTER PLACE · STRAND · W.C.2

SC/11

The Chemical Age

Established 1919

The Weekly Journal of Chemical Engineering and Industrial Chemistry

BOUVERIE HOUSE 154 FLEET STREET LONDON E.C.4
Telegrams: ALLANGAS FLEET LONDON · *Telephone:* CENTRAL 3212 (26 lines)

Volume LXIV 16 June 1951 Number 1666

Science in the Coal Industry

WE can judge the National Coal Board by its results and by the story it tells. By the latter criterion* the Board might be thought to be paying scant attention to science. Only three out of the 276 tightly-packed pages of its Annual Report for 1950 are devoted to science in the coal industry. Yet happily we know the situation to be very different. Never before in the history of British coal has so much scientific effort—much of it chemical—been so intensively applied. Soon now we hope the results should start to be coming forth—in patents, new working processes, published papers and scientific memoranda. From last year's more informative Report we gained a picture of many-sided research activity, some of it directly under the ægis of the Board, some in the hands of sponsored organisations. It would have been valuable to have had a more communicative interim account of the results. We must hope that brevity here is intended to offset more extensively early detailed scientific publication.

In particular, before turning to discuss what the Report *does* contain, we must draw attention to one other important omission. Last year we asked if any investigation had been made to determine the facts concerning the trends in the dirt content of coal. We are glad to read that the drive for cleaner coal has continued; manufacturers should benefit from the sixteen new cleaning plants with a capacity of 4.8 million tons a year which were brought into use.

But what are the tendencies in British seams? We often hear generalised statements that seams are getting thinner and dirtier. Is there any evidence of this other than the *ad hoc* judgment of mining engineers? Furthermore, the 'race' which is significant to industrialists is just this: is the tendency to work dirtier seams and to bring up dirtier coal faster or slower than the rate of installation of washeries? Briefly, must we bargain for dirtier or cleaner coal for our boilers in the future?

While this question is not answered, there is much that one can learn, nevertheless, from this document.

The chemist's contribution is often coyly hidden away, not under the headings where one might first look, but as a part of the Report quaintly headed 'Making Coal Go Further'—and the like. Thus there is no doubt as to who is basically to be thanked for the fact

* National Coal Board. Report and Accounts for 1950. London. HMSO. pp. X + 266. 5s. 6d.

that washery water is now treated by flocculation, thus at one stroke salvaging coal and minimising river pollution. By the end of last year, the discharge of effluents into rivers had been stopped at nine washeries of the South Western Division and projects were in hand at ten more. Incidentally, the Divisional Scientific Service also carried out a comprehensive national survey of water discharge from mines, to find out how far it polluted rivers and streams.

Another vital contribution, jointly by chemists, chemical engineers and mechanical engineers is in raising the efficiency of use of coal. This is of vital concern to the Board. Unlike a private concern, they are mandated to supply their product in such quantities and qualities as will serve the public interest. To this they pay attention in principle and practice. The first step is to ensure that nothing that will burn is lost; most important here is to devise means of making use of slurry or 'middlings' from washeries, having ash contents between 15 and 40 per cent. Fine coal, hitherto wasted, can be briquetted, with or without carbonisation. Quite generally, the Board are actively interested in processed fuels, the most important of which are the products of carbonisation. The possibilities of producing all coke to consistent standards of quality have yet to be fully exploited.

In the section on Scientific Control there is the interesting announcement of the issue of a standard 'Analyst's Handbook' for use in N.C.B. laboratories. This is a policy step of considerable importance. If standard methods—notably British Standard Specifications—are not satisfactory, it is essential that moves be started to revise them. If the Board is using different methods from those standard outside its own scientific service, analytical results may well be different and disputes endless. Are the methods of suppliers and customers being taken into account in drawing up this volume, or are the methods simply those which have been used in the industry in the past? Coal is so vital to all other industries, including our own, that uniformity and agreement on testing methods are absolutely essential. We hope this will not be neglected.

To sum up, this Report hints at some valuable scientific work being in progress. Four years after vesting date is time enough for the public to have more than hints. Let us now see some full publication.

On Other Pages

British Plastics Exhibition	907	*Chemist's Bookshelf*	929
Chromatographic Analysis	911	*Market Reports*	931
Place of Plastics in Industry	915	*Home News Items*	932
Industry and Raw Materials	919	*Overseas News Items*	933
Shell Annual Report	921	*Publications and Announcements*	934
Early Chemical Engineers	923	*Personal*	936
Fisons Acquire Chilean Sulphur Options	927	*Commercial Intelligence*	938
		Next Week's Events	939

The annual subscription to THE CHEMICAL AGE is 35s. Single copies, 9d.; post paid, 1s.; SCOTTISH OFFICE: 116 Hope Street, Glasgow (Central 3970). MIDLANDS OFFICE: Daimler House, Paradise Street, Birmingham (Midland 0784-5). THE CHEMICAL AGE offices are closed on Saturdays in accordance with the adoption of the five-day week by Benn Brothers, Limited.

Notes & Comments

Automatic Lab. Boys?

AN American research laboratory appears to have accepted guidance from the modern kitchen in its washing-up problems. A local labour shortage having dammed the supply of lab. boys, the director first tried training charwomen in the gentler art of cleaning test-tubes and beakers, etc. This proved a costly failure. Breakage expenses rose sharply and the wastage of cleaning solvents and detergents was heavy. Research delays were caused through the breakage of special apparatus. It seemed that pairs of hands well used to washing dishes or scrubbing floors could not be trained to handle laboratory glassware more gently. It was decided to experiment with an automatic family dish-washer. Although it seemed too much to hope that this type of machine would meet the special cleaning demands of laboratory apparatus, the first test was in fact outstandingly successful. In under fifteen minutes most of the glassware could be taken out of the machine clean and dry. Further experience has shown that while the more heavily soiled apparatus requires two or three wash cycles and a limited number of cases may require individual attention with a stiff brush; the main bulk of the 'wash' can be left entirely satisfactorily to the automatic dish-washer. Apart from the saving in time and labour, the consumption of detergents is down by at least 25 per cent. Breakage costs are minimised. This may not actually be an innovation in laboratory practice. Other laboratories may have adopted similar methods without reporting their success. In this American case, the results have been so satisfactory that automatic dish-washing machines are now being ordered for other laboratories. It is stated that the capital outlay is repaid by the savings made in as little as two months.

Insecticide Containers

IT is no secret that this spring and early summer British manufacturers and distributors of insecticides and weedkillers have been seriously handicapped by the shortage of drums. In some cases certain packs have been temporarily unavailable. It can be argued, of course, that this is a general symptom of deficiency in the chemical industry but it falls with special hardship upon agricultural chemicals. These materials have a sharply seasonal use. They are often ineffective unless applied at the right period in crop growth or pest attack. Delays caused through lack of containers will in many industries lead to nothing worse than equivalent delays further along the production line. In agriculture and horticulture the production timetable is settled by the calendar and the weather; external factors of delay cannot be passed on.

Priority Dispensation

A SIMILAR scarcity of drums—particularly the 55 and 5 gallon sizes—occurred in America earlier this year, but prompt official action was taken in Washington. The National Production Authority (NPA) got together with the U.S. Department of Agriculture and a special directive was issued to manufacturers of drums to provide the insecticide industry with specified quantities of these containers. In return for this priority dispensation, the industry had to certify that all steel containers received were to be employed in distributing liquid forms of insecticides usually used for crop protection; also, that the new supplies would not be used for excessive stock-building. In times of general scarcity, firm and official guidance for the flow of essential goods and materials is an inescapable necessity. No one could sensibly accuse the United States of being a control-loving nation. Nevertheless, Washington in this matter seems to have shown a quicker and sounder sense of responsibility than Whitehall. What seems to be needed is a realisation that the usual delay accorded to articles in short supply is likely to do more in this case than merely keep someone else waiting. Nature waits for no man, and nothing short of quick, direct action will prevent a lot of insects having a hey-day this summer.

Improving Converters

American Iron & Steel Institute Discussion

A WIDE range of new developments were discussed at the 59th annual general meeting of the American Iron & Steel Institute held recently in New York.

Bessemer converters can be made to increase their output and thus provide more hot metal for open hearth steelmaking by injecting oxygen into the normal air blast and charging more scrap, W. G. McDonough, superintendent of the open hearth and bessemer department of the National Tube Company, McKeesport, Pennsylvania, told the meeting. By using 4,000 to 6,000 cubic feet of oxygen per 'blow' the normal steel scrap charge in a 30-ton operation can be increased by about two tons, and blowing time can be decreased by about one minute.

This method offers a practical means for melting additional scrap to increase ingot tonnage when a deficiency of hot metal exists. The hotter temperatures do not damage the refractory brick lining and bottom of the converter.

Pointing the Way

A recently developed instrument which measures air temperature within the furnace, is pointing the way to increased open hearth steel production, it was claimed by John S. Marsh, research engineer, Bethlehem Steel Company. The most important finding with the new device, called a 'velocity couple,' is that the higher the air temperature in an open hearth furnace, the shorter the time required to make steel.

Use of the velocity couple has indicated places where loss of air temperature is likely to occur and thus is expected to prove invaluable in the design and engineering of future furnaces.

Blast furnaces making essential ferromanganese can be prevented from giving off a dense fume to pollute the atmosphere, according to a report by five United States Steel Company technologists, C. A. Bishop, A. H. Brisse, R. G. Thompson, C. R. Liebel and W. A. Swaney.

Control of air pollution by furnaces making ferromanganese differs from that needed to clean gas from pig iron furnaces. Laboratory tests, conducted to determine methods that would remove the very fine fume which makes up 80 per cent of the impurities in the gas from a ferromanganese furnace, showed that this foreign matter could be removed by spraying the dirty gas with water, precipitating the fume electrically, burning it and pressing it into briquettes. Briquetting is deemed necessary to prevent the collected fume from being blown away by the wind during disposal.

Describing a pilot plant built expressly to test laboratory findings, it was claimed that the visible effect of the special cleaning of furnace gas was impressive in that no fume at all was discernable. As a result of this work, a plant has been designed to clean 135,000 standard cubic feet of ferromanganese blast furnace gas per minute.

Superphosphate Association

THE International Superphosphate Manufacturers' Association held its annual series of meetings in Lucerne recently, at the invitation of the Swiss manufacturers of superphosphate, at which some two hundred and sixty delegates were present from twenty different countries, including representatives of the industry from as far away as Australia, India and the U.S.A.

Delegates were entertained at a banquet in Lucerne by the Swiss superphosphate manufacturers, and excursions to the Bernese Oberland and other places of interest were also organised.

For the year 1951/52, the following officers were elected or re-elected:—Mr. R. Standaert (Belgium), president; Mr. R. Audouin (France), Mr. A. Bloembergen (Holland), Mr. J. Capelo (Spain), Mr. B. Colbjornson (Sweden) and Mr. H. Stevenius-Nielsen (Denmark) vice-presidents; and Mr. R. M. Collins, secretary.

A series of technical meetings will be held in Paris in September next, at the invitation of the French members.

The *Scientific Digest*, published twice annually by the Association's Agricultural Committee, is now available also to members of the general public, on application to the Central Office at 32 Old Queen Street, London, S.W.1.

Wolfram Price Increase

The London price of wolfram has again advanced. On 6 June it was being quoted at 560s. to 570s. per unit c.i.f., compared with 555s. to 565s. on the day previous and 545s. to 560s. on 5 June.

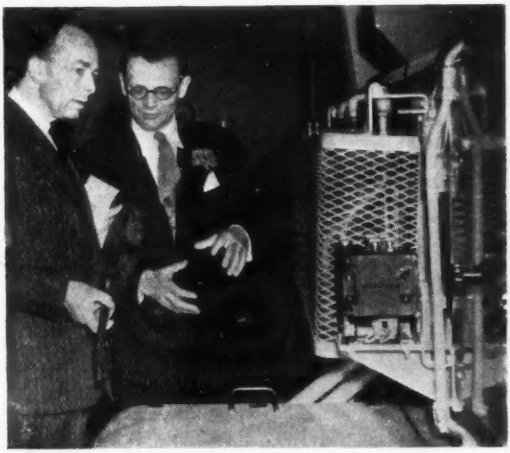
British Plastics Exhibition

Enormous Range of Products Displayed

THE 1951 British Plastics Exhibition at Olympia which was opened on 6 June by the President of the Board of Trade, Sir Hartley Shawcross, K.C., M.P., is a revealing display of the versatility and value of synthetic plastic materials. Housed on two floors of the gigantic hall, it contains the stands of nearly 100 exhibiting firms of all kinds, ranging from the producers of the moulding powders, to the firms making plastic toys as a finished product. Indeed, one firm is showing a working injection moulding machine turning out phenolic plastic ukelele cases by the dozen.

The stands are extremely well laid out. Monsanto Chemicals' exhibit consists mainly of their Lustrex polystyrene plastic now in large-scale production at their new factory at Newport, Monmouthshire, a photograph of which is on show on the stand. This substance can either be clear or coloured, and a range of brushes, torch lenses, powder and cosmetic cases made from it shows the versatility of the plastic. Its electrical characteristics are claimed to be outstanding, being an insulator equal to any synthetic resin, and applications on show include components for aircraft, car, radio, television and the electrical industries. Another interesting part of the Monsanto stand is showing a range of chlorinated diphenyls and polyphenyls known as 'Aroclors', substances not previously manufactured in this country. They are primarily of interest as plasticiser extenders which can replace as much as 40-50 per cent of substances like dioctyl phthalate in PVC and still retain the physical properties, while improving flame resistance. Heat and light stability is claimed to be greater with these 'Aroclors' than with any other extenders. Also on this stand are phenol, orthocresol/phenol mixtures, and other intermediates.

The I.C.I. stand is a most interesting and attractively laid out piece of work. Mainly devoted to describing the activities of the Plastic Division's Technical Service and Development Department, this stand shows some remarkable exhibits of research and development work on 'Perspex' and rigid PVC in the lighting industry. A striking example is that of 'piped light', in which a coil of solid 'Perspex' tubing transmits light introduced at one end through the coil, and produces it undimmed at the other, while at the same time remaining only faintly luminescent itself. Other applications of 'Perspex' are on view, including the use of 'Perspex' sheet. 'Welvic' PVC



Sir Hartley Shawcross, President of the Board of Trade opened the British Plastics Exhibition on 6th June. Concurrently with it until 16th June a convention was held covering progress in materials, development of plant, fabrication and applications. The photograph shows Sir Hartley holding a ukelele case made by an injection moulding machine

pastes occupy a portion of the stand, and gloves, handbags and other finished products made from it are present. The use of 'Alkathene' in the home and in industry are also portrayed.

Thomas De La Rue & Co., Ltd., exhibit a stand showing the part that the company's products play in everyday family life. Entitled 'Mr. Everyman in Plastic Land', the many uses of 'Formica', in such applications as chair covers, cloths for the kitchen, etc., are shown. 'Delaron', another product of the firm, is shown in radio and television sets, in telephones and Ewbanks; pens, screwdrivers and other extrusion plastics are also on show. 'Formica' is also shown outside the home, and a model of a railway carriage reminds us that railways use it for their seat and cushion covers.

Casein Ornaments

Erinoid, Ltd., have a most attractive stand. Giving examples of their products made from cellulose acetate, polystyrene, casein and so forth, they show a beautiful blue plate in casein, as well as a type of ornamental umbrella handle. Toy boats, lampshades, radio cases figure largely as well, and a display of coloured samples stretches along one side of the stand consisting of examples of the cellulose acetate films of Utilex, Ltd., an associated company. These dazzling films are used mostly in the packaging field, they can be produced in any thickness from 3 to 20 thou., and can be made either coloured clear, coloured opaque, plain, or embossed with designs. They can be welded together with special high frequency welding equipment, glued, or formed under heat and pressure as well as printed upon. They are used for spotlights in the theatre, being non-inflammable, and uses such as the covers for confectionery boxes, transparent rigid containers for flowers, lampshades and the usual run of many different types of toys are amply exhibited.

An interesting material on view at the stand of Thermo-Plastics, Ltd., is laminated fibre-glass, a material that is coming into use where chemical and electrical resistance and strength are of primary importance. Helmets made from it are exhibited, the material giving the curious appearance of being made of compressed hair, the colour being whitish with a mottled brown in it. Other parts of the stand show examples of injection and compression moulded articles which the company is producing to customers' specifications. Some of the largest complete plastic components made in the country are also shown—whole refrigerator linings, advertising signs and so forth. At the stand next door belonging to J. F. Kenure, Ltd., examples of the company's nylon and polythene funnels in five different sizes in use the world over, are shown.

The fascinating process of actually moulding the plastics is exhibited at the stand of the Projectile & Engineering Co., Ltd., who show a series of these machines at work producing various plastic articles. These machines are made to 2, 4, 6, 8 and 16-oz. capacities. The 2-oz. and 4-oz. machines are self-contained and built on a prefabricated base that incorporates direct hydraulic lock action; they have a high rate of injection and very simple mould-setting arrangements.

R. H. Windsor, Ltd., also have on view several types of moulding machines. The latest development in the field of extrusion machinery is on view in three different models with capacities of 65, 100, and 200 lb. each. These new extruders handle with ease all thermoplastic materials and will extrude to very close tolerances the most difficult substances, such as unplasticised vinyls. They are equally useful for compounding, colouring and pelletising vinyl, cellulostic and polystyrene materials. These multi-screw machines, say the firm, are the only British designed and manufactured ones there are. They are based on the Italian LMP.

Range of Modern Toys

Next door to R. H. Windsor, Rosedale Associated Manufacturers, Ltd., are showing what modern toys can look like and the range that plastics cover in this field. Toys not seen before include model bagpipes complete with inflatable rubber bag, but whether or not these are working models as far as sound is concerned is not clear. Perhaps for parents' peace of mind, it is to be hoped they are not. These toys are designed by the firm.

Redifon, Ltd., and Rediweld, Ltd., mainly concerned with fabrication for the chemical industries, show a variety of chemically resistant apparatus and plant components, including tanks lined with polythene, polyisobutylene and rigid polyvinyl chloride sheet, as well as pipelines made from these

materials. A working model of a metering wheel for hydrofluoric acid is on view, as well as an agitation coil for an electroplating tank and various dipping baskets and trays. Welding equipment is also being shown by the company.

British Xylonite Co., Ltd., an associated group of five companies—B.X. Plastics, Ltd., Halex, Ltd., Cascelloid, Ltd., Scintillex, Ltd., and Expanded Rubber Co., Ltd., are showing an interesting range of exhibits. The latter company specialises in the production of several types of expanded materials—'Onazote' a hard, ebony-like substance. 'Rubazote', a soft sponge rubber for packaging, and 'Fuff'. 'Onazote' was used a lot during the war for boom defences, being a hard, expanded ebonite with remarkable properties of thermal insulation and buoyancy. It possesses a closed cell type of structure, as does 'Rubazote', and this makes it virtually unsinkable. 'Rubazote' itself is an expanded rubber of great protective powers, and its use in egg boxes and the like is ably demonstrated on the stand. Many valuable cargoes have been transported next to 'Rubazote', say the company.

Finally, 'Fuff', done up in transparent rigid containers and looking for all the world like sugar icing, is a foamed urea-formaldehyde much used by Christmas decorators and film studios for artificial snow. The stuff weighs little, but we learn that the film studios when they get hold of it use tons. 'Halex', Ltd., are, of course, well known to all who clean their teeth, and 'Scintillex', Ltd., have developed an attractive metallic colour for personal jewellery articles.

Room in Plastic

Bakelite, Ltd., and Warerite, Ltd., go so far on their stand as providing not only examples of the plastics they make, but a room furnished with them. A pleasant green light diffuses into it through the plastic, and Warerite hard-surfaced, smooth plastic sheets are shown as part of the wall and on furniture. It becomes difficult in the end to tell what is plastic and what, if any, is not. The more practical side of the stand, however, is devoted to a wide display of the many products made from the company's materials. These include a large range of electrical articles made from Bakelite, from switches to radio cabinets. The unique properties of Bakelite, Warerite and Vybak make them especially valuable, say the company, where electric insulation, light weight and smooth surface are required. Silent gear wheels and pinions are also on show and these demonstrate vividly the case where plastic has replaced metal on its merits. The company have only recently begun to make Bakelite urea moulding materials and Vybak thermoplastic vinyl compounds.

Laminated Plastic

The stand belonging to Tufnol Ltd. is devoted to exhibiting their laminated plastic 'Tufnol.' Various shapes and sizes of tubes, bars, sheets and so on are made from this plastic and supplied to specification. Exhibited are a range of products where 'Tufnol' is doing duty in engineering, including small gear wheels, pinions and bearings. Running silently on water lubrication only (or oil or other types of lubrication if desired), the makers say that it is not a substitute for any other material, but possesses its own virtues of lightness (it is half the weight of aluminium), strength, electrical insulation and corrosion-resistance. It also, being plastic, is slightly resilient and absorbs shock well.

United Ebonite & Lorival, Ltd., show an effective stand with details of the products they make in the home and everyday life of the man-in-the-street. These are not all. Industrial contributions include bobbins used for cotton spinning, which are being shown in a special textile section together with many other parts used in the textile industry. Transport takes a section, as well as the electrical industries.

British Moulded Plastics, Ltd., and their associated company Moulded Products, Ltd., are showing an example of plastic mouldings made in their factories more than 25 years ago. One is the horn for one of the old sound-box gramophones, made from phenol-formaldehyde, and very efficient it looks. A most intriguing stand this, it shows what the firms claim to be the biggest compression moulding in the world, a console television cabinet made from phenolic material which stands 3 ft. high and weighs 32 lb., as well as a complete tenor saxophone moulding in Diakon acrylic plastic—an attractive, orange-coloured instrument. A large motor-car panel is also shown in polystyrene, and a clear Diakon bowl for the compass in a fighter aircraft is exhibited. Gramophone turntables moulded from phenolic plastic are another recent article being produced by the firm. Many other

articles, made from the wide range of plastic materials available, are also being shown.

Ashdown's, Ltd., are exhibiting several objects made from 'Perspex' including an observation turret of the type used in light naval craft, as well as some extrusions in PVC. Their 50 per cent fabric and paper-based laminates, they claim, save 20 per cent in cost over the ordinary fabric insulators, and on show are several examples of the laminated electrical products.

Plastics in Textiles

A variety of enterprising types of cloth are being shown by Storey's of Lancaster. This firm market 'Storeen'—a printed PVC film which is useful instead of fabric for curtains, aprons, etc., with the advantage that it does not stain, run, crease or get eaten by moths. Being as the firm call 'Texturised', it feels uncommonly like fabric. 'Storolan'—another type of plastic cloth—is exhibited in a variety of table and shelf coverings, as well as in leathercloths made of PVC, rubber, and nitrocellulose, and 'Norzon', a newcomer to this country, is a remarkable imitation suède, for footwear.

E. K. Cole, Ltd. (Plastics Division), makers of the famous EKCO radios, exhibit a variety of mouldings used in the radio industry, as well as accessories like tuning knobs with contrasting rims moulded in a single process, wave-change levers, and loudspeaker and car-radio speaker cases. A lattice grille for radios and a large range of Belvedere and Priory toilet seats in eleven different colours are other examples of the scope of the Ekco plants, which range from 1 oz. and under, to 16 lb. compression moulding, and from ¼-48-oz. injection moulding.

British Resin Products, Ltd., show a comprehensive range of their products. Mostly these are moulding materials, adhesives, surface-coating resins and industrial resins. Adhesives made from Cellobond synthetic resin are used a lot in the plywood and furniture industries as well as in aircraft and ship-building. Their advantage lies in being water-resistant and heat-resistant. The industrial resins are used for impregnating and laminating, bonding, etc. This firm also market resins derived from cashew nut shell liquid—the only firm in the country that do—and these are used particularly in the making of brake linings.

An educational survey designed to put the public and anyone else wise to their polyvinyl products is the stand of British Geon, Ltd. Grouped under three headings—what Geon makes, how it is used, and why it is used, this stand explains the development of the resins and the use which the vinyl plastics industry makes of Geon, and how the consumer industries and the home uses these products. The first section deals with the wresting from the earth of the Geon raw materials—the vinyl resins. These are made from limestone, air, water and coke. The second section deals, like a flow sheet, with the various processes through which the Geon raw materials pass, to give the characteristic vinyl secondary products in the form of vinyl resins, co-polymer resins, paste resins and latex, etc., and the third section exhibits the final uses of these products.

Many different forms of plastic sheeting and films are the speciality of British Celanese, Ltd. On show at the exhibition are the raw materials from which they are made and the end-products which result. The range exhibited includes Celastoid sheeting, including optical quality, Celastoid extrusions, Clarifoil transparent film and Cinemoid special non-inflammable sheeting, for use in the cinema industry. Uses of the various products shown cover such a wide range as perambulator handles, watch glasses, lampshades, umbrella handles, and overwraps for window cartons.

Surface Protection

Fescol, Ltd., show a vivid example of the protection afforded to hydraulic rams used in the plastics industry by the process of electro-chemical deposition they call 'Fescolising'. Done in nickel or chromium, this provides, say the company, a non-corrodible surface to rams which lasts in many cases for many years without the necessity of replacing packings. Two rams are shown on the stand, one 'Fescolised' and the other not. The untreated ram is badly corroded, the treated one as good as new.

A stand out of the usual run of things is a small additional one by I.C.I. in which they show some remarkable examples of sculpture and engraving in 'Perspex' by Fleischman, Josephina de Vasconcellos and others. This remarkable material has an attractiveness all its own when worked in this way.

Chromatographic Analysis in Germany

New Techniques for Colourless Compounds

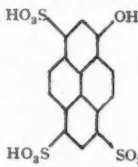
SINCE the well known method of using ultra-violet light and fluorescence to show up colourless compounds in a column was introduced, as described for example by Dr. T. I. Williams in his 'Introduction to Chromatography' (Blackie & Son, 1948), continuous attempts have been made to improve the technique. Among those which deserve attention are the investigations of Professor H. Brockmann, of Göttingen University. His recent work is described in *Angew. Chemie.*, 1951, *63* (6), pp. 133-136 (21 March), being the report of a lecture delivered at the 49th annual meeting of the German Bunsen Society, Marburg, 19 May, 1950. It is based to some extent on earlier research undertaken in collaboration with F. Volpers.

The present paper deals with the problem of using the fluorescent method for compounds of which the absorption lies in the region between 220 and 320 mμ, for which improved adsorbents and better illumination of the column are necessary. In order that adsorbents should be capable of fluorescence through suitable 'colouring,' materials are required that are not dissolved by the adsorbed substances (adsorbates) even with strongly eluent solvents, and which can be used in such small amounts that their presence does not appreciably affect adsorption.

Shorter Wave Materials

Hitherto the pentaoxyflavone Morin has fulfilled these requirements in the case of $CaCO_3$, MgO, and the much used Al_2O_3; while Berberin has proved suitable for silica gel. But both have their optimum effect

(I)



with the long-wave u.v. light, and are of relatively little use below 300 mμ. Attempts to find other materials for the shorter range (220-300 μ) have so far resulted in one success only, that for alumina, namely, 3-oxypyrene-5,8,10-trisulphonic acid (I) as prepared by Farbenfab. Bayer, of Leverkusen.

Using only 80 mg. of the sodium salt of this compound with 1 kg. of Al_2O_3, a bright green fluorescence was obtained which, with the long-wave u.v. light, was much more marked than when using 600 mg. Morin with Al_2O_3, and still more pronounced in the short-wave zone. The oxide should first be acidulated with HCl. This new colouring matter is not dissolved even with strongly eluent solvents, and the adsorptive capacity of the Al_2O_3 is in no way affected. It is interesting to note that if the sodium salt of (I) is used in alcoholic solution the fluorescence of the oxide is blue, but if in aqueous solution it is again green. It has not yet been possible to find a suitable colouring agent for silica gel. for use with the shorter wave-lengths.

Another Method

The author has earlier pointed out that, in the case of adsorbents made fluorescent by colouring, the zones can also be made visible by the fact that the adsorbed colourless substance extinguishes the fluorescence of the colouring material used. Whether such extinction is due to secondary adsorption, or to reaction between the adsorbed compound and molecules of colouring agent present on its surface, is not yet clear.

In any case the light absorption of the colourless substance plays no decisive rôle. Its zone becomes visible when the light source illuminating the column is of longer wave-length than the absorption range of the colourless substance. This means that under certain conditions even very short-wave absorbed compounds can be identified under the lamp using Morin-alumina or Berberin-silica gel. Some samples are tabulated in respect to acetophenone, benzaldehyde, and anisaldehyde, with various colouring agents. In addition to Morin and (I), other colouring agents giving good visibility with Al_2O_3 were 8-oxyquinoline and 2-oxy-3-naphthoic acid.

Luminous colour adsorbents: Coloured adsorbates must not usually be heated above 150°C. to avoid destruction of the colouring agent, so that with Al_2O_3 and other materials the high temperatures at which they are

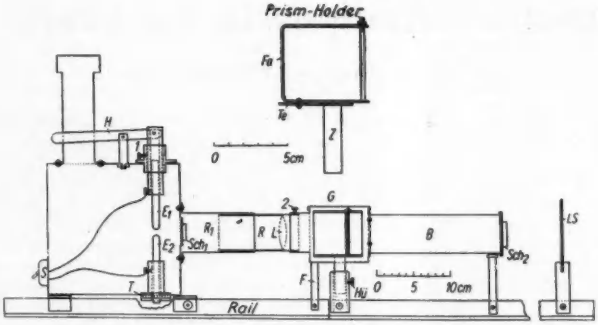


Fig. 1.—Side view of the monochromator used

most active must be avoided. This disadvantage is overcome by using luminous colours which have the further advantage of not being specific: one of them can be used for any adsorbate. Professor Brockmann first used a green phosphorescent preparation made by Riedel-de-Haën, but this was not suitable for rapid series work at different wave-lengths, as with the monochromator—described below, and it became necessary to find a luminous colour that had bright fluorescence in short wave u.v., good miscibility with adsorbents, no phosphorescence and was relatively insensitive to heat. These requirements were met by the K4 green/1 of Dr. Franke, of which only one per cent was needed, reckoned on weight of adsorbate, to give a very bright fluorescence.

Illuminating the adsorption columns: In order to make the method adaptable for compounds that are not appreciably absorbed at 366 mμ, and therefore not visible under the lamp, light from a mercury low pressure lamp with a filter combination was used, the Hg line 253.7 mμ being filtered out; but since the light yield was only about 20 per cent a larger filter diameter was required. The Oldenberg chlorine filter was found suitable for the purpose, after getting over the difficulties due to the length of the glass cuvette (25 cm.) and the need for effective sealing.

To ensure that optimum contrasts between the zones and the empty parts of the adsorption column may be obtained each zone must be illuminated with a wave-length corresponding to the chief absorption maximum of the substance in that zone; so that a light source is required, the wave lengths of which can be widely varied. This can only be achieved with a monochromator and a wide wavelength range light source.

As light source an iron arc was used, the electrodes being placed in a suitable con-

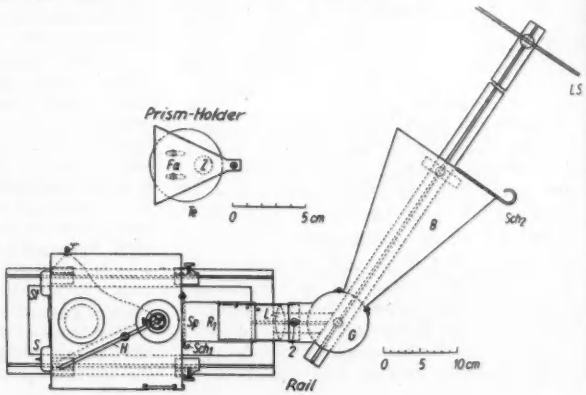


Fig. 2.—Plan view of the monochromator

tainer with a viewing window. Electrode E_1, movable by lever H is earthed, and the lower insulated electrode E_2 is fixed and connected with switch S and rheostat. Light from the arc passes through the opening Sp (3-4 mm.) on to quartz lens L in tube R (focal distance 100 mm. and diameter 50 mm.). Tube R is positioned and movable as shown, and held by screw 2. The whole is mounted on an iron rail on which the lamp unit is movable.

The prism housing with removable cover (G) is attached to the rail by means of bar F, its base being perforated to take the prism-holder, the height of which can be adjusted by the set-screw at Hu, also its angle of rotation. After switching on the arc the spectrum is formed by suitable adjustment of lens and prism on a screen LS; and by means of shutter Sch_2 the visible part of the spectrum is cut out and the now invisible spectrum falls on the rear part of screen which has been turned accordingly.

By suitable positioning of the chromatograph tube to be studied (quartz) in front of the screen it is easily possible to select the most suitable wavelength for identifying the zones. If the adsorption column contains compounds with widely varying absorption ranges, then, as the column is moved, the various wavelengths appear and gradually disappear, starting with the longest.

Making the U.V. Spectrum Visible

As luminous screens for making visible the u.v. spectrum in the monochromator, various methods of preparation were tried, *e.g.*, pasteboard coated with a mixture of luminous colour and glue, or, when necessary, aluminium oxide coloured with oxypyrene-trisulphonic acid (I). By soaking cellophane sheet in an alcoholic solution of the sodium salt of (I) transparent luminous screens were obtained, but these only imperfectly absorbed or dispersed the incident light. On the other hand if parchment paper was used in the same way, the screens so obtained were much more efficient, down to 214 mμ.

Photographic indication of the colourless zones: A method is described for indicating the colourless compound zones of the column by photographic means, in conjunction with the ordinary u.v. technique. The set-up is shown in Fig. 3. No fluorescent adsorbents are required. E is the light or arcing unit (electrodes), C the chromatogram with invisible zone U, K is the camera with lens and shutter in tube T, together with holder and clip (M, F) for photographic paper P. An ordinary camera may be used with a tube containing a quartz lens of 3 cm. diameter and 10 cm. focussing distance. The picture is taken as shown from an upwardly inclined direction to eliminate reflection.

Separation of stilbene derivatives. In conclusion the author describes a few illustrative examples in the identification of

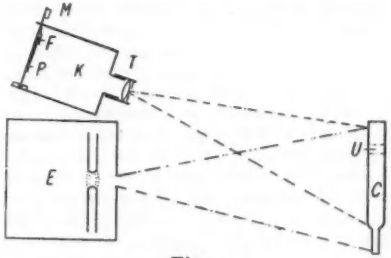


Fig. 3

various stilbene derivatives, being largely a reproduction of some earlier work.

Amber Chemical Industries Ltd.

DIFFICULTIES foreshadowed in last year's statement have made themselves evident in the accounts for the third year's trading of the Group of Amber Chemical Industries, Ltd. In the statement by the chairman it was pointed out that steps had been taken to eliminate as far as possible all sources of future loss arising from the redundant stocks, and the sales of packed pharmaceutical specialities had been discontinued.

In the fine chemical field, production problems had continued, and, in common with most other manufacturers, the future supply of certain raw materials continue to give anxiety.

Production of industrial chemicals continued to increase in volume and prospects for this and the merchanting side of the Group's activities remained good.

Loss for the year ended 31 December, 1950, amounted to £27,912, of which £13,397 had been carried forward into 1951. This adverse balance had, however, been eliminated in the first three months of the current year's trading.

Italian Sulphur Prospects

Naples Consultant Critical of U.K.

IN our issue of 19 May we published a letter which we had received from Mr. C. H. Davies, a trade consultant living in Naples, criticising an article which we had published in a previous issue entitled 'Outlook for Italian Sulphur' (*see* CHEMICAL AGE, 14 April, p. 553). Since then Mr. Davies has written us another letter in which he repeats his contention that several thousand tons of sulphur are available in Italy at present and that regular deliveries could be made if contracts were forthcoming. If the proper liaison was established he is sure that Italian sulphur would be made available in quantity, at prices averaging around 50 per cent above the American level. He believes that all the Italian producers need is some practical encouragement to increase their output. He maintains that no country can easily raise her economic level without the active interest and help of others and objects to the distrustful and critical attitude which he believes other countries have shown towards Italy.

Concessions Necessary

Mr. Davies states that the Italian sulphur industry is of vital importance to the whole world. Its depression was to some extent caused by forces outside of Italy and its recovery will come only by help from outside that country. In the initial stages he believes that some concessions must be made to the Italian producers.

Our correspondent claims that he recently wrote to the Board of Trade in Britain offering to assist British users obtain supplies of sulphur from Italy. His offer was turned down, it being said that any sulphur imported from Italy would probably be set off against our next quarter's American allocation.

Mr. Davies feels that the British Government is being most unrealistic in its outlook and that until it and other European governments change their outlook there is little prospect of the Italian sulphur industry making much recovery. It is his firm contention that the sulphur is available there in considerable quantities but that her producers are not being encouraged to increase output in spite of the fact that there is a world-wide shortage.

Metals Licensing System

AN Order made by the Minister of Supply (Mr. G. R. Strauss) extends the licensing system for unwrought copper, lead and zinc from 2 July to include licensing of scrap and residues of these metals.

Under the order a licence will be necessary to acquire, treat, use and consume copper, lead, lead alloys and zinc; and any scrap or residue of these metals or their alloys. The order—The Copper Lead and Zinc Distribution Order 1951 (S.S.I. 1951 No. 981)—was published on Wednesday, 6 June.

Those likely to be affected by this order should apply immediately for a licence to the Directorate of non-ferrous metals Ministry of Supply, 20 Albert Street, Rugby (Tel: Rugby 2131).

Before a licence can be issued, a return of stocks on 31 December, 1949, 31 December, 1950, and 31 March, 1951, will be required. Certain records and returns will have to be kept and rendered thereafter.

A licence will not be needed to acquire scrap or residues up to 13 tons in all over a period of 13 weeks provided the metal is only cleaned, crushed or sorted. A licence will be needed to use any quantity, however small, for melting, remelting, making secondary ingots or any other purpose.

The new order revokes the Control of non-ferrous metals No. 35 (Copper, Lead and Zinc Order) 1949 (S.I. 1949 No. 2087) but any licence under that order remains valid.

I.C.I. Manager Honoured

The general works manager of the Dalton Works, I.C.I., Ltd. (Dyestuffs Division). Councillor G. B. Jones, the Mayor of Huddersfield, who received the M.B.E. in the King's Birthday Honours List, laid the foundation stone of the extensive new three-storey buildings which are to accommodate the senior and administrative staff, together with the engineering and commercial departments of the Dalton Works.

Mr. Jones was performing one of his last duties as the general works manager, for he is to retire at the end of the month after 34 years' service with the firm. Mr. Jones referred to his start at the works in 1917 and mentioned that the new offices would be completed in about 18 months' time and would form an impressive entrance to the town from the Leeds Road direction.

The Place of Plastics in Industry

Sir Ben Lockspeiser Opens Plastics Convention

SPEAKING on 6 June on 'The Place of Plastics in Industry' at the opening of the British Plastics Exhibition and Convention, Sir Ben Lockspeiser, K.C.B., F.R.S., secretary of the DSIR, said that there is a tendency to look to plastics as a way out of the current shortage of raw materials. This ignored the economics of the problem, and there was no present means whereby the production of synthetic materials could substantially affect the world supply of basic materials.

To replace only 10 per cent of the wool output at its present level of 1,600,000 tons per annum by synthetic material, he said, would involve a capital outlay of between £300-£400 million which is not far short of the estimated capital investment in 1950 of £435 million for the entire U.S.A. chemical industry. If the whole of the capital employed in the British plastics industry were applied to ease the wool or cotton supply, the total quantitative effect would be little over 8 and 5 per cent respectively of the British imports of these materials.

'Nor', said Sir Ben, 'can one overlook the fact that the plastics industry has its own serious raw material problem. In fact, the production of synthetic materials has risen so rapidly over the past few years that it is now in sight of outrunning its supply of feed-stock. Fortunately, new processes developed in the oil industry promise, in the long run, to provide the plastics industry with a more abundant supply of raw materials at a relatively low cost. These technological advances are likely, moreover, to furnish new materials and so make possible the synthesis of new compounds.

Conservation Rôle

Continuing, he said:—

Within its existing resources the plastics industry has a considerable rôle to play in the conservation of certain relatively scarce materials by providing better ones. We have to eke out our supplies of, for example, lead, wood and leather, and although these materials will continue to hold their own in many fields there are others for which synthetic products have proved themselves superior. The supply and use of lead is a matter of much concern. In the electrical industry, in particular, the problem of replacement of lead as a protective sheathing in communication cables has become acute. The alternatives are either another metal or a synthetic material, and of these aluminium and polythene and polyvinylchloride have shown the greatest promise. Polythene especially has been found suitable for submarine and other cables in circumstances where resistance to corrosion is an all-important factor. It is estimated that about 2,000 tons of lead could be saved per year by the use of only a fraction of this weight of polythene. Its use as an insulator in the interior of cables is already established.

Extension Inevitable

Plastic materials have been developed which can be shaped and threaded and will keep their shape even when used with hot water. These have been used successfully, especially where corrosive liquids are concerned, and their wider extension is inevitable, such as their use in conveying food products without imparting a taint or colour.

The greatest use for materials alternative to leather lies in the making of boots and shoes, since 80 per cent of the leather output of this country finds its way to footwear. The merits of leather for uppers have scarcely been challenged. It is for soleing material that the use of leather is most seriously challenged by rubber composition and particularly by the resin-rubbers of American origin. About 25 per cent of the footwear in this country, and 50 per cent in the U.S.A., employ soleing material other than leather, and, of the latter, the recently developed resin-rubber neolite, a material largely originating from styrene, appears to be the most popular. It is sold on its merits and not as a substitute; that is, on its advantages of cheapness, long life and uniformity of product, in spite of certain disadvantages not yet overcome. The chief obstacle to development in this country has been the need to import styrene-butadiene copolymer for compounding with natural or synthetic rubber, but this obstacle is likely to disappear as home production develops.

It is estimated that if 10,500,000 pairs of shoes—7 per cent of present U.K. annual production—were made with resin-rubber soles the reduction in leather consumption would amount to 14,500,000 lb.

Balsa Wood Substitute

Early in the war the need to find a lightweight substitute for balsa wood eventually led to the adoption of foamed calcium alginate as the supporting material, but the investigation into the theory and the practical problems of sandwich construction also led to the more exact specification of core material. As a result, increasing use is now being made of this method of construction and there is little doubt that wider application could in some instances save up to 50 per cent of timber.

The waterproof properties of laminated wood and the strength and wear-resistant properties of densified wood bonded with synthetic resin are by now well known. We are not likely to return to the use of animal glue in this field. The great success of the bonding of metal to wood for certain early in the war to experimental work on the bonding, of metal to wood for certain parts of aircraft, and later to the bonding of metal to metal. The elimination of drilling and of riveting in the construction of the shell by bonding metal to metal has been carried to its maximum by what has become known as the Redux process. The saving in time, labour and cost in the assembly of metal plates and shapes to each other and to the stringers, is estimated to approach 50 per cent, and the task of inspecting each of the thousands of rivets formerly used is avoided. Moreover, the area of contact extends over the whole surface concerned, and the joint is thereby the stronger. The importance of the saving in weight of up to about 20 per cent on the whole shell needs no emphasis.

Components of all kinds—receiving sets, cables, domestic fittings—have been provided in bulk at a low cost. The millions of plastic components of many kinds assembled in a modern telephone exchange serves as an example. This field of application now belongs to plastics, and the wide use of plastics for stationary components is becoming increasingly extended to moving parts. In the textile industry, for instance, plastics and plastic-bonded materials are increasingly employed for pulleys, cams, quiet-running gears, precision moulded pirns, bobbins and other more complex parts. Such parts are required in quantity and can be manufactured and finished complete to the necessary limits of precision and smoothness by mass production methods. They are usually lighter in weight than the equivalent metal components and, being non-corroding and requiring no lubrication, there is a commendable absence of rust and oil spray.

It is evident that from early use as substitute material, plastics have moved rapidly into the field of specialised application. Basic materials have been developed which by their unique properties have brought about entirely novel fields of application. This is exemplified by the methacrylate polymers which, like polythene, are a development of British origin. From early use as denture plates and the 'Perspex' windows of aircraft, its optical properties have rendered it unique for contact lenses, television lenses and diagnostic instruments. A further exceedingly valuable property of some plastics, particularly of methacrylate polymer, is that by which strains in a heated model can, as it were, be frozen in the material by cooling under load. The photoelastic patterns remains when the load is removed and can be examined, three dimensionally if necessary, at leisure. Dynamic strain in moving parts can also be examined in this way, and the field of experimental stress analysis by photoelasticity has been greatly enlarged by this use of plastic models.

Ion Exchange Resins

Much attention has recently been paid to the ion-exchange resins, which perhaps do not properly belong to the plastics field. As distinct from plastics proper, they function solely on account of their chemical properties by forming insoluble complexes with metallic ions on the one hand or with acidic ions on the other. This property was put to use in Germany during the recent war in the recovery of copper from cuprammonium wastes and silver from photographic wastes. Much attention is now being directed to the possibility of economic recovery of zinc from pickling acids and of nickel, cobalt, gold and other precious metals from plating liquors. In many instances the technical feasibility of an ion-exchange process has been demonstrated but the economics are still uncertain.

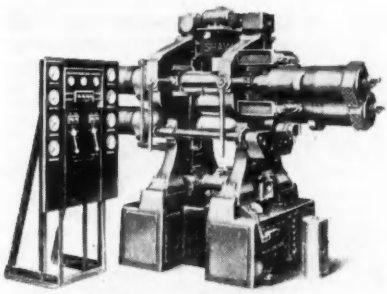
A new field of specialised application has been opened by the introduction of the silicon and fluorine plastics. One of the fluorine plastics, polytetrafluorethylene (known as PTFE) is not only remarkable for its ability to function at relatively high temperatures, up to 250°C., and for its almost complete resistance to corrosion, but also for its outstanding anti-friction properties. Its friction coefficient is considerably less than that usually obtainable by good lubrication and is comparable with that associated with ice. Such a material may prove useful as a bearing material which will function without lubricant and at a relatively high temperature. It has the disadvantage, however, of being a poor conductor of heat and of having a high thermal expansion coefficient. Nevertheless, it has been found possible to obviate these defects by impregnating the pores of sintered metal with Teflon so that, for example, a bearing might be produced which had the mechanical properties and thermal conductivity of the sintered metal and an impregnated surface with the antifriction properties of Teflon.

Whereas in the early days the small variety of plastic materials were looked upon as interesting chemical compounds whose uses were mainly in the provision of cheap substitutes, interest has now moved to the fundamental nature of polymerisation and to the possibilities not only of explaining effects in terms of molecular arrangement, but also of controlling the polymerisation of single monomers, or of mixtures of of basic monomers with a view to arriving at a desired result. This stage has been reached with the aid of physical science, which has revealed the molecular structure of so many other compounds, and it is in the light of an accumulation of information so acquired that empirical advances are now being superseded by development on the basis of fundamental knowledge.

New Laboratory Calender on Show at Olympia

FRANCIS Shaw & Co., Ltd., of Manchester, have designed and are showing at the British Plastics Exhibition at Olympia a new laboratory calender. This calender has been primarily designed as a small prototype for laboratory use and to provide data for the design of larger machines incorporating similar features, although not necessarily of identical design. Each of the 16 by 8 in. rolls is driven by an individual variable speed motor, thus enabling any desired friction ratio to be obtained between the maximum and minimum speeds of the rolls, or all rolls can be driven at even speed. Flood lubrication to the main bearings is incorporated from a separate pump which also feeds the main gear boxes. An interlock prevents the main motors being started up before the oil is circulating at the correct pressure and if this pressure fails the calender will stop.

A zero-clearance arrangement is fitted to the top roll to maintain correct nip-setting under all load conditions. Each roll adjusting screw is driven by its own motor. The control panel incorporates individual tachometers for each roll so that any desired combination of roll speeds can be obtained on the control panel by push-button control. Oil pressure and temperature gauges are grouped together conveniently.



New Laboratory Calender

Superintendent Awarded B.E.M.

The Birthday Honours conferred by His Majesty The King on 7 June include the award of the British Empire Medal to MR. F. A. LOVETT, who joined British Thomson-Houston in 1904 as chief assistant in the Winding Department, and is now superintendent of the Insulation, Varnish, Stove Enamel, and Resin Factories, which position he has held since 1939.

Sir Ernest Benn Fined

Considered Census a Waste of Money

SIR ERNEST BENN, publisher, and president of the Society for Individual Freedom, of Oxted, was fined £5 and ordered to pay £2 2s. costs at Dorking on Wednesday of last week for refusing to fill up a census form.

Sir Ernest is chief proprietor of THE CHEMICAL AGE.

Mr. W. H. J. Parish, prosecuting on behalf of the Registrar-General, said that when the enumerator called for the census he was handed the schedule, on which were written the words 'In view of the critical state of the national economy, I must refuse to take part in this unnecessary waste of manpower, money, paper, and print.'

Mr. H. J. Hamblen (defending) said that Sir Ernest was now, and had been all his life, a champion of the matters he had at heart. Foremost of these was what he regarded as the grave encroachment being made to-day on individual liberty. He hated with a passionate hatred the encroachment of Government activity into the sphere of the individual. He was proud that 24 years ago it was his responsibility to publish the book which was probably the forerunner of the attitude of mind which a good many people hold regarding government-by-Order. That book was 'The New Despotism', by the late Lord Chief Justice, Lord Hewart.

Mr. Hamblen said that on the day Sir Ernest was asked to fill in the census form, he had in one hand the Chancellor of the Exchequer's estimates for the ensuing year and in the other the census paper. He noticed that the sum required by the Chancellor was in the neighbourhood of £4,000 million, to be extracted from the taxpayer during the ensuing year. When he appreciated that that sum was a figure far in excess of the peak period during the war, he turned to look at the census form and thought, 'What a shocking waste of public money—what a shocking enquiry or encroachment on the privacy of the individual.'

Director's Estate

MR. HARRY WORTHINGTON, former managing director of Higginbottom & Co. (Manchester), Ltd., chemical and metal merchants, left £16,067, net £15,864.

Transfer of Research

NPL Work to be Done by MERO

SOME of the work being done in the Engineering Division of the National Physical Laboratory is being transferred to the new laboratory of the Mechanical Engineering Research Organisation, DSIR, at East Kilbride, near Glasgow.

The main section of the research work to be transferred is that concerned with the strength of materials at ordinary temperatures, including fatigue of materials, failures in service, mechanical design problems, gas cylinders, mechanical tests on metallic and non-metallic materials, and general mechanical testing techniques. For the time being the work on the strength of materials at high temperatures will remain at the NPL but it is scheduled to move to Scotland in due course.

The move involves the transport to Scotland of about 120 tons of machines and scientific equipment; this is planned to start about mid-June and will probably take about one month to complete.

There are also at NPL sections of MERO working on fluid mechanics and mechanics of formation. These sections will be transferred to Scotland in August.

The headquarters of the organisation, together with the Lubrication Division, the Machine Shaping Section and parts of the Mechanisms and Formation Section, have been at Tortonhall, Glasgow (a few miles from East Kilbride), for some time.

From 1 July inquiries relating to the strength and properties of materials at ordinary temperatures should be addressed in the first place to: The Director, Mechanical Engineering Research Laboratory, East Kilbride, Glasgow.

Tanganyika Oil Plant

His Excellency, the Acting Governor, E. R. E. Surridge, on 14 May laid the foundation stone of the buildings for a new plant of Messrs. Victoria Oil Mills, Ltd., in Mwanza. The new factory represents an important step in the industrialisation of Tanganyika. The factory is supplied by Bamag, Ltd., of London, and will represent the latest in cottonseed oil refining technique. It will include the new high-vacuum, non-drip deodoriser, which needs less steam and cooling water than other deodorisers.

Industry & the Raw Materials Crisis

Effects of Steel and Sulphur Shortages

DETAILS can now be given of a survey carried out in April on the effect of the raw materials shortage on a representative cross-section of British industry.

The survey, conducted by Aims of Industry, Ltd., a non-party educational organisation for industry, clearly showed that the shortage of raw materials of all kinds has forced a grave crisis on industry.

Opinion of a sample two per cent of the 55,000 manufacturing establishments in Great Britain was tested by the investigation. They were asked to assess the effect of the raw materials shortage on their individual industries, enquire into reasons for the crisis and suggest remedies.

Replies showed that engineering, clothing, housing, food, and the paper trades are among the worst hit by current shortages in steel, sulphur, paper, cotton, glass, timber and bricks. Main conclusion from the replies was that these shortages would prevent British factories from achieving the 40 per cent increase in output, and the extra £500 million in export earnings urged in the Government's Economic Survey for 1951.

The disastrous impact of the steel shortage on the engineering industry was vividly exposed. Many firms in steel-producing areas of Lancashire, Yorkshire and Scotland reported that their normal supplies of sheet, plate and bar steel had been cut by 50 per cent in the last six months, with similar cuts in iron, zinc, brass, copper, and aluminium supplies.

Total Collapse Admitted

One of many Yorkshire blast furnaces in difficulties because of the shortage of scrap iron needed for smelting, admitted 'a total collapse in production' and elsewhere in the West Riding vital blast furnaces have been damped down in recent weeks as scrap iron supplies dried up.

A Liverpool works said its exports were dwindling because tinplate supplies were down, and for the same reason a Manchester firm with 80 per cent of its production centred on essential rearmament and export work, reported a 50 per cent loss in output.

Many replies condemned widespread 'scrambling and panic buying of steel' in the northern factory areas. Steel-producing mills, already handicapped through a severe shortage of sulphur, protested that heavy loads of steel plate and steel sheets were piling up at the mills because there were not enough railway wagons to transport the steel to factories.

Steel Cuts Drastic

Some steel cuts have been drastic. A London firm of galvanised wire makers, for example, has had its monthly delivery of ten tons of steel reduced by 80 per cent. A Rotherham, Yorkshire, firm of boiler-makers reported that it is being compelled to work with 100 tons less steel a month. East Anglian farm-tool makers said that their steel suppliers were not accepting any orders due for delivery before 1952. Other steel-using factories in Bolton and Manchester said they were now reconciled to a 12-month delay in deliveries.

Why is there a famine in steel? 60 per cent of the firms taking part in the survey were critical of the Government's failure to build up steel stocks before the rearmament programme was put into action. They were critical, too, of the diversion of shipping normally employed to bring iron ore from America to Britain—to bring coal from Pennsylvania to Newcastle. Over-selling of our raw materials to dollar markets last year, particularly tinplate, was another popular criticism.

And the remedy? Most manufacturers agreed that Government bulk-buying of steel should end, giving firms freedom to buy overseas wherever they wished. Continental steel markets were much favoured. Some firms suggested that all kinds of steel should be rationed again, supplies allocated according 'to bona fide needs.' Other manufacturers strongly favoured working a six-day week in the steel-making and steel-producing industries; all insisted that the present system of steel allocation was wrong. Quotas instead of being based as at present on each firm's requirements in 1938, they said, should now be fixed according to their needs over the past six months.

Many manufacturers were convinced that the only immediate solution to Britain's steel

crisis was action at Government level on the sharing-out of vital raw materials.

Paint manufacturers in Birkenhead and Aberdeen reported that prices of pigments and other chemicals had jumped 400 per cent in the last few months. For the severe paint shortage, they blamed 'over-exportation of pigments,' shortage of sulphur, rearmament and stockpiling, and claimed that the paint shortage compelled firms to turn down thousands of valuable orders for white and light-coloured paints every day.

In north-east shipyard areas paint manufacturers demanded that re-importation at inflated prices of British paint pigments should be stopped and controls restored to guarantee a priority paint supply for warship repairs and construction. Paint exports of all kinds should be severely reduced, it was claimed, and Britain given a much larger sulphur allocation.

Cuts in our sulphur imports have reduced output of rayon yard, and rayon users have called for a big reduction in exports.

Instrument Maintenance

City of London Institute Courses

THE City and Guilds of London Institute announce the adoption of an important new scheme of courses and examinations in Instrument Maintenance (Subject No. 79), which has been drawn up by an authoritative advisory committee including representatives of industry, the Society of Instrument Technology, the Ministries of Supply, Fuel and Power, and Education, the Service Departments, major engineering professional institutions, and associations concerned with technical education.

The scheme is intended to meet the needs of mechanics and technicians concerned in the maintenance, repair and installation of the instruments used for process and production control in industrial plants and in H.M. Forces. Particular attention is given to the requirements of the chemical, iron and steel, and petroleum industries, to fuel economy, and the needs of the Services, but the structure of the scheme is such that it will be found to have wide application.

The course of part-time study is of five years' duration, with an Intermediate Examination at the end of the third year, and a Final Examination at the end of the fifth year. There is provision for students holding an appropriate Ordinary National Certificate to enter the course at the beginning of the fourth year.

It is hardly necessary to stress the importance of instrumentation to modern production technique and control, but the dearth of properly trained instrument maintenance mechanics has tended to be a serious handicap to the maintenance of instruments actually installed, and a deterrent to the full application of instruments where their proper use could be of distinct advantage.

Courses to be provided under the new City and Guilds scheme will be held in technical colleges, and it is hoped that they will go a long way to ensuring the proper training and education of instrument maintenance mechanics. Education authorities will generally be found to be very willing to provide such courses where a sufficient demand can be shown to exist, and in courses of this character it is most essential that throughout all stages the co-operation of industry and education authorities should be close and continuous.

A pamphlet containing the regulations and syllabuses for the City and Guilds examinations will be available shortly, price 6d., from the City and Guilds of London Institute, Department of Technology, 31 Brechin Place, London, S.W.7.

Atom Exports Up

BRITAIN'S exports of isotopes—radioactive chemicals from the Atomic Energy Research Establishment, Harwell—reached their highest-ever figure in May with Eire and France as the best customers.

During the month, 236 consignments left this country by air for destinations ranging from Australia to Eire. In addition, some packages travelled by sea to France.

This figure compares with 211 consignments exported in April and 155 in March. It brings the total number of shipments since the beginning of the year to 961, compared with 483 in the same period of 1950.

Eire and France each received 71 shipments last month, Germany, with 36, being next on the list.

In all, 17 different countries received air shipments in May. They were (apart from those mentioned), Austria, Belgium, Denmark, Holland, Italy, New Zealand, Norway, Portugal, South Africa, Spain, Sweden, Switzerland and Turkey.

12,000,000 Barrels a Day

Shell Annual Report Tells of Further Progress

IN his statement to the annual general meeting of the Shell Transport and Trading Company, Ltd., on 23 May, the chairman, Sir Frederick Godber, outlined the prospects of the oil industry in the world to-day. World production of oil, he said, was now at the rate of 12,000,000 barrels daily, over five times as much as it was in 1920 and twice as much as in 1938, and this figure was an increase of 2,000,000 barrels daily over what it was three years ago. Saying that the industry's task in meeting the rising demand for oil in the future would be made easier if it were freed from the unnecessary restrictions imposed upon it, Sir Frederick welcomed the agreements concluded this year with two major United States owned oil companies. If the world demand for oil increased at the same rate as it had done over the last three years, oil production would need to be increased by another 2,000,000 barrels a day, and he was pleased to say that an important and even overriding factor in bringing about the American agreements had been the rapid progress achieved in the refinery expansion programme of the British oil companies. Sir Frederick also paid tribute to the British manufacturers of oil equipment, who had played an important part in encouraging American companies to spend their sterling in the Sterling Area.

Activities Surveyed

A survey of activities of the company during 1950 is contained in an attractive booklet laying out details of exploration work carried out by the company, production development, manufacture, transportation, marketing, research and personnel. The growing importance of exploration and surveying work is emphasised. With each successive increase in the rate of withdrawals from existing oilfields it becomes more important to find other sources hitherto untapped; but it is not easy, says the report, to be certain of oil's presence below ground in commercial quantities from surface indications alone. This increases the importance of carrying out exploration operations in countries which are of a stable political and economic condition. Few exploration ventures call for such vast amounts of capital as does oil, and international competition is very great. Areas explored in 1950 by the company included further fields in the United States (including a second field in the gulf waters of Louisiana), Canada, South America, Nigeria, the Netherlands, the Middle East. Unsuccessful results were obtained in Somaliland, and Egyptian activity was suspended pending the outcome of negotiations.

Oil Production Figures

Production of crude oil has been successfully increased by 8 per cent over 1949, and the total group supplies have increased to 18 per cent over the 1949 level, largely from sources outside the U.S. The oilfield at Seria in British Borneo (*see* CHEMICAL AGE, 24 March, 1951) has again increased substantially in output and at the end of the year was producing 100,000 barrels daily. Several important new manufacturing plants have been completed to add to the company's distillation capacity, and all the plants completed in 1949 gave a full year of operation; all refineries, except for Haifa, were run at maximum capacity. At home, the thermal reforming unit at Stanlow on the Manchester Ship Canal was brought into operation in May, ahead of schedule, and the first stage operations at Shell Haven on the Thames Estuary were started, also ahead of schedule, following the completion in November of the crude oil distillation unit and auxiliary treating plant. Refineries in the U.K. have now reached the figure of 108,000 barrels of crude oil processed daily.

The chemicals section of the Shell Company reports a record level of activity in the U.S.A. At Houston, Texas, an Epon resin plant was completed in November for the production of mainly surface coating resins which are finding extensive applications in industrial and aviation fields. Further expansion of manufacturing capacity, notably of the synthetic glycerine plant, was started. The U.S. Government plant at Tarrance, California, for making butadiene, was brought back into production by Shell Chemical Corporation, who have been entrusted with its management.

The chemical plant at Stanlow continued to manufacture a wide range of chemical products, and agricultural chemicals increased in output steadily, part of the production being exported. The Associated Ethyl Co., Ltd., in which the group has a substantial interest, started work on a large plant close to the Stanlow refinery for making tetraethyl lead, and they will use intermediate chemicals from the Stanlow refinery—this will save many dollars.

Transportation in 1950 was increased by 1,250,000 deadweight tons in the total tanker tonnage controlled and chartered by the group, and by the end of the year amounted to 5,250,000 deadweight tons. As a result of research, the diesel engines of 27 ships of the company have been operating satisfactorily on high viscosity fuel in place of diesel fuel, thus effecting substantial economies. The rest are being converted.

Markets for petroleum products, reports the survey, have steadily increased during 1950, a feature of the post-war period, and the group has been able to meet the increased demand for petroleum products to the full, thanks to the heavy programme of investment in restoring and extending market facilities during the last five years.

Wide Research Field

Research during 1950 was carried out over a wide field, covering fundamental chemistry and physics, applicational research and the improvement of exploration, production and manufacturing techniques, at centres in the U.S.A., Great Britain and the Netherlands. In the agricultural sphere field work was carried out, and the effect of biocides on various crops under different climatic conditions was studied. In America a 'Shell' cotton defoliant was perfected and successfully marketed. Equipment was developed for low-volume spraying of biocidal products, both from the ground and from the air. Metal corrosion was greatly reduced in refinery and oilfield equipment, and in the U.K. the development of the most suitable fuel for jet engines is still in progress. Special additives for fuels and lubricants were developed during the year for preventing the formation of deposits in internal combustion engines or making them harmless. Work carried out at the Amsterdam laboratory led to important improvements in refining and chemical production, including the removal of impurities from gasoline and other products, simplification of the process for the de-waxing of oils, and improvement in the quality of detergents.

Low U.S. Accident Rate

Chemical Plants Safest in Country

CHEMICAL plants are among the safest places in the U.S.A. in which to work, according to figures released by the Manufacturing Chemists' Association of New York. A record figure of 4.56 injuries per million man-hours worked was achieved in 1950 by the association's member companies, which account for about 90 per cent of total U.S. chemical production. 'This accident rate is less than half the national average,' Dr. A. G. Cranch, chairman of the association's safety committee, said, 'and lower than that of any other industry except communications.'

Chemical injury rates have been substantially below the average for all industry for many years, according to Dr. Cranch, 'but chemical plants have made especially notable progress in reducing industrial injuries since 1946.' The average rate for the association's member companies has dropped 40 per cent during the past five years. Dr. Cranch attributes this record to improved safety measures adopted in the industry and to good co-operation by employees in observing safety rules and precautions. Accident frequency and severity rates in MCA member company plants over recent years are as follows:—

	Frequency Rate	*Severity Rate*
1946	7.64	0.69
1947	6.96	0.78
1948	6.37	1.06
1949	4.84	0.65
1950	4.56	0.73

The collection and dissemination of statistics on chemical plant safety has been an activity of the association's general safety committee for a number of years. This committee is also actively engaged in keeping the industry informed of latest safety techniques. With the assistance of the association's medical advisory committee it has prepared thirty-nine chemical safety data sheets. These are used by industry throughout the world as authentic sources of information on how to handle chemicals safely and what to do in first aid.

Early Chemical Engineers

Professor D. M. Newitt Looks Back

THE text of the presidential address by Professor D. M. Newitt, D.Sc., F.R.S., given to the Institution of Chemical Engineers on 18 May, has just been released for publication. In part, the address was as follows:—

Chemical engineering, as a distinct branch of engineering, cannot, I think, claim to be more than a century and a half old and I believe most of us would be willing to regard Edward Charles Howard (1774-1816) as being the first chemical engineer of any eminence; but during the preceding century we can trace clearly the origins of the heavy chemical industry and other associated industries which eventually gave rise to the need for this special type of technology.

By the end of the 16th century such industries as there were had reached that stage of growth at which further progress was handicapped by the want of sources of power to replace the horse and the primitive water wheel, and of materials of construction to enable the newly discovered principles of mechanics and hydraulics to be applied in more refined forms than had up till then been possible. For the time being theory had far out-stripped practice.

The Rotary Pump

Contemporary writings (among which must be included patent grants and specifications) contain abundant evidence of inventions which, owing to the lack of materials and tools, could not be incorporated in the industrial practice of those days. One remarkable example is that of the rotary pump which will be found described and illustrated in a work published in Paris in 1588 and entitled 'Le Diverse et Artificiose Machine del Capitano Agostino Ramelli.'

One of the best illustrations of the difficulties engineers were meeting with is afforded by the mining industry, which was becoming involved in deep mining operations on an ever increasing scale. Improved methods of haulage, pumping and ventilating were badly needed and many new devices were suggested and tried out. A number of these will be found described and illustrated in the first modern classic on technology, the 'De Re Metallica' compiled by Georgius Agricola (Bauer) in 1556.

Attempts Unsuccessful

It is sometimes a matter of surprise that the applications of the steam engine and the force pump for raising water were so long delayed. The early volumes of the Philosophical Transactions contain numerous references to successful demonstrations of models of these engines, but attempts to construct and operate large units were for a long time unsuccessful.

The early history of cylinder construction is bound up with gun-making and with the efforts of civil engineers to build force pumps and pipe lines for the raising and distribution of water supplies. The first gun makers borrowed their technique from the coopers and built guns like casks—a series of longitudinal bars being held together by iron hoops. When brass guns were introduced they were bored by a hand operated boring bit.

The Marquis of Worcester is perhaps now best remembered as the author of a curious book entitled 'A Century of the Names and Scantlings of Inventions by me already Practiced' (1663). He seems to have been a typical inventive genius fertile of ideas but without the practical faculty for working them out. There is, however, in his book a significant entry:

'Fire-driven Water'

'No. 68. An admirable and most forcible way to drive up water by fire, not by drawing or sucking it upwards. I have taken a piece of a whole cannon, whereof the end was burst, and filled it three-quarters full of water, stopping and scruing up the broken end; as also the touch-hole; and making a constant fire under it, within 24 hours it burst and made a great crack; so that having a way to make my vessels, so that they are strengthened by the force within them, and the one to fill after the other, I have seen the water run like a

constant fountain-stream forty feet high: one vessel of water rarified by fire driveth up forty of cold water.' As in so many other instances, the author gives no details of the principles upon which this important claim is founded.

I should like to mention another interesting personality, known to all lovers of 'Pepys' Diary,' Sir Samuel Morland (1625-1695), Master of Mechanicks to the King. We are, among other things, indebted to him for the first quantitative measurement of the relative volume of steam evaporated from a given volume of water, for data on the capacity of pipes and for being the author of the first engineers' pocket book.

More Practical

A far more practical character than the Marquis of Worcester was his contemporary, Thomas Savery (1650-1716), a military engineer of inventive turn and considerable commercial acumen. Although his claims have been challenged, I think it must be conceded that he made considerable technical advances in pumping practice. A steam engine for pumping water out of mines was patented by him in 1698 and a working model was demonstrated to the Royal Society in the following year. The practical application of his invention was, however, retarded by the difficulty of constructing a safe boiler and cylinder.

Savery later employed Newcomen who made substantial improvements not only in the design of his engine but also in the methods of construction. In particular, he replaced the brass cylinders and lead pipes of the early engines by cast iron cylinders and pipes which he obtained from the famous iron works at Coalbrockdale in Shropshire.

Iron Smelting Process

I think there is but little doubt that it was at these works, then recently taken over by Abraham Darby, the first of a great dynasty of ironmasters, that the process of smelting iron with mineral fuel was first successfully practised. By 1724 his works were largely engaged in the production of cast iron cylinders, barrels and pipes for pumps.

The next important advance in cylinder technique was due to John Wilkinson of the Bersham Iron Works, who, about 1775, introduced a method of boring by means of a long stiff cylindrical bar mounted on bearings at each end and fitted with a cutter head which could be traversed along the bar. For many years Wilkinson applied all the cylinders used by Boulton and Watt. 'Mr. Wilkinson,' wrote Watt in 1776, 'has improved the art of boring cylinders so that I promise upon a 72 in. cylinder being no further from absolute truth than the thickness of a thin sixpence in the worst point.' From then onwards improvements in the design of boring machines and other machine tools were rapid and the availability of well cast and accurately bored cylinders led to an immediate expansion in the use of steam power in industry.

From the standpoint of the chemical engineer, the most important phase of this new application is to be found in salt and sugar refining processes. Progress in the technology of these industries form an interesting comparison since both are largely concerned with the unit operation of evaporation.

A Model Treatise

The best account of the technology of salt manufacture in the early 18th century is contained in a remarkable work by William Brownrigg entitled 'The Art of Making Common Salt as now Practised in Most Parts of the World; with several Improvements Proposed in the Art, for the Use of the British Dominions.' (London, 1748). This book might serve in many respects as a model technological treatise, dealing as it does with the history of the industry, the chemical and physical processes involved in the manufacture, the design and lay-out of the plant, the method of operation and suggested improvements.

The method of salt manufacture as then practised in this country consisted in evaporating brine in shallow, flat bottomed, rectangular pans, sometimes as much as 20 ft. in length and 12 ft. in breadth. The plates used to form the pans were of malleable iron, about 4 ft. 6 in. long, 1 ft. broad and one-third of an inch thick. In order to avoid corrosion the sides of the pan were sometimes made of lead. The pans were contained in enclosed buildings known as Salterns, provision being made

for the escape of steam through openings in the roof.

Brownrigg gives full details of the method of evaporation including means for precipitating colloidal material, for removing insoluble carbonates and sulphates, and for regulating the size and purity of the product. He also gives one interesting footnote about pre-heating the sea water by waste flue gases (p. 54) which indicates that fuel economy was beginning even in those days to occupy the attention of the salt manufacturers.

Heat conservation and fuel economy, however, although very much in the minds of 18th century technologists made slow progress. Various tentative suggestions are to be found among the patent specifications of those days for utilising the sensible heat of the flue gases and the latent heat of the steam from the boiling pans. The application, however, of the principle of multiple effect evaporation whereby the steam from the liquid evaporating in one pan could be used to boil the liquid in the succeeding pan had to await the development of vacuum technique which we owe primarily to the technologists of the sugar industry.

Double-Bottomed Pans

The 'equipage,' 'copper wall' or 'Jamaica train' of the sugar refinery corresponded with the 'saltern' and consisted usually of a battery of five boiling pans heated by means of a furnace. The pans were of relatively small capacity and a stricter control of the rate of boiling was necessary than with brine, in view of the danger of boiling over with consequent fire hazard. No special arrangements for heat conservation and recovery appear to have been introduced until as late as 1785 when Thomas Ward proposed the use of double-bottomed or jacketted pans heated by steam.

The early years of the 19th century, from which may be said to date the birth of chemical engineering as a distinct technology saw two big advances in evaporation technique which established the basis for design of much of the plant in use today. The first was the introduction of steam heating by means of fixed coils immersed in the liquid; and an extension of this method by William Cleland and Wetzel whereby partly immersed coils were rotated and a crude form of film evaporation took place. The second was the invention of the vacuum pan with its ancillary equipment by Edward Charles Howard.

Howard was a brother of the twelfth Duke of Norfolk and was a chemist of some distinction. His patent on vacuum evaporation (No. 3754,1813) well deserves to be studied for its clear and comprehensive exposition of the principles of the process.

In it, he also gives details of the relation between pressure and boiling point and of various devices for operating vacuum vessels.

Vacuum Evaporation

Vacuum evaporation was immediately adopted by the industry and the records of Boulton and Watt contain details of a number of refineries equipped by them with this type of plant; the royalties paid to Howard between 1813 and the year of his death, 1816, bear witness to the rapid exploitation of his invention.

One of the most important aspects of Howard's work is the stimulus it gave to the development of multiple effect evaporation. Between 1825 and 1840 numerous crude forms of multiple effect were tried out both in the sugar and salt industries. William Cleland, the inventor of the Cleland pan, is usually given the credit of having originated the idea; but an examination of his patent (No. 5394, 1826) indicates that he had only a very imperfect understanding of the relation between the various stages. Degrand, Pecqueur and Derosne produced rather more refined designs but there is little doubt that the first efficient double and triple effect evaporators were the work of Norber Rillieux.

Comparatively Modern

The pestle and mortar, the flat stone and the edge-runner mills date back to a remote antiquity. The three-roll mill is a comparatively modern product and its development is closely associated with the sugar industry; it is said to have been invented by Pietro Speciale, Prefect of Sicily, in 1449. In its earlier forms the rolls were constructed of wood and were mounted with their axes vertical, the centre roll being geared to the two outer ones. Iron plated rolls were introduced in the beginning of the 17th century and later (1652) George Sitwell of Rendshaw

constructed rolls consisting of iron shells covering wooden cores.

The horizontal three-roll mill first appears among a collection of drawings by John Smeaton, the inventor of the blowing cylinder, in possession of the Royal Society, and one is known to have been constructed by John Collinge in 1794. Improvements particularly in the design of the headstock were made by Dunhanan (1658) and Rousselet (1871) but belong to a period subsequent to that with which we are dealing to-day. The three-roll mill revolutionised the operations of grinding and crushing in many industries and can be regarded as another development of the first importance to chemical engineers.

John Stewart was an American who, for some obscure reason, was also known as Robert Bainey. He was associated for many years with the sugar industry and about the middle of the century conceived and developed the idea that the 'fire engine' could be adapted to the driving of crushing rolls, steam from the evaporating train being used to operate the engine. He envisaged evaporating under pressures above atmospheric and generating power in condensing engines at about 5 lb. gauge.

John Roebuck (1718-1794) is known to those interested in the history of the iron and steel industry as one of the founders of the Carron ironworks, but he also has claims to be considered as one of the finest practising chemical engineers. Born in Sheffield in 1718, he studied medicine at Edinburgh where he came under the influence of J. Black and imbibed that love of experimental research which influenced his whole subsequent career.

Precious Metals Refining

Working in his own laboratory Roebuck was responsible for numerous improvements in the methods of refining gold and silver, and as a consequence was led to interest himself in the manufacture of vitriol. In 1746 he and his partner, Samuel Garbett, constructed the first lead house or chamber and later (1749) built the first chamber acid factory at Prestonpans. The introduction of the lead house did for the heavy chemical industry what the vacuum pan did for the sugar and salt industries and must rank with it as one of the major contributions to chemical technology of the 18th century.

The adoption of the chamber process led to an immediate reduction in the price of acid and gave a tremendous impetus to the heavy chemical industry. By 1790 lead houses 20 ft. long by 11 ft. high were in use and in 1820 there were 23 sulphuric acid factories operating in England, of which no less than seven were in London.

I must now close this brief survey. I have by no means exhausted the list of lesser worthies who, during the period immediately antecedent to the Industrial Revolution, made significant contributions to science and technology; but by making a selection from among those engaged in a wide variety of industries, I hope to have sufficiently emphasised the great and sometimes quite unexpected influence which discoveries of a minor character may exert on the direction and progress of industry in general.

Pharmaceutical Society Officers

THE new president and vice-president of the Pharmaceutical Society (elected on Wednesday, 6 June), are MR. F. C. WILSON, secretary of Surrey Pharmaceutical Committee, and MR. W. JOHN TRISTRAM, who owns three pharmacies in Liverpool.

Mr. F. C. Wilson

Mr. Wilson served his apprenticeship with his father, Mr. W. Wilson, in Bradford, where he also was a chemist and druggist before coming south in 1946. He qualified in Edinburgh in 1927, and, at 45, is the Society's youngest president since it was founded 110 years ago. Mr. Tristram was apprenticed to the late J. W. Mainprize, Otley, and qualified in 1919. He has been chairman of the Society's Public Services and Ethical Committees, of the Pharmaceutical Advisory Committee and in 1944-5 of the National Pharmaceutical Union. He has been a member of Liverpool City Council for 17 years and is an alderman and magistrate.

MR. W. SPENCER HOWELLS, 108 Kew Road, Richmond, Surrey, a former president of the Society, has been re-elected treasurer, an office which he has held since 1947.

Fisons Acquire Chilean Sulphur Options

Vast New Source to be Exploited

A PRESS conference was held at the Savoy Hotel on Tuesday by Fisons, Ltd., at which it was announced that one of the firm's representatives, Mr. J. M. Langley, had just returned from Chile where he had headed a mission to investigate and exploit the largely untapped sulphur deposits in the Andes chain. The opinion was expressed that there was enough sulphur available there to last for 50 to 60 years and that with proper development it would be possible to solve the world's sulphur problem.

Welcoming members of the Press, Mr. Guy Pearsons, a director of Fisons, briefly outlined the background and causes of the present sulphur shortage. The Government, he said, had recently invited sulphur users to find independent sources of this element and Fisons, as one of the largest users in the country, had picked on Chile and had sent Mr. Langley out there to investigate the situation. He then introduced Mr. Langley who had only arrived back on Sunday.

Mr. Langley told of his trip to Antofogasta on the coast where he had met local sulphur producers and Chilean miners. From the first he was convinced that there was plenty of sulphur in Chile. Deposits seemed to run the whole length of the Andes but he decided to go to the central block and so went by train up country and then drove 300 miles by automobile to the main sulphur producing area.

Difficult Working Conditions

Several of the mine workings were situated at an altitude of 20,000 ft. where the atmosphere was so rare that it supplied less than half the oxygen available at sea level. The temperature, moreover, was never more than 4°C. at mid-day and the only people who could work at these heights were Bolivian Indians. The men lived at 17,000 feet and were carried up to the working by the same method by which the ore was brought down—*viz.*, aerial bucket railway.

The sulphur was being mined by pick-axe and shovel although some blasting was carried out. The ore, which was of excellent quality—between 50 and 80 per cent sulphur—was dug up in 50 to 60 lb. blocks but the Bolivian miners handled them easily. It was carried down the mountains some 12 miles and then placed on a train and carried a further 12-15 miles to a refinery. The autoclave process was used.

Mr. Langley was convinced that there was a vast potential waiting to be developed. Roads could be built and with modern methods enough sulphur could be obtained to meet this country's needs.

As is natural, neither Mr. Pearsons nor Mr. Langley were prepared to say very much about Fisons' plans to develop this source, but the former said that it was a certainty that after the trouble they had taken to find the sulphur, they were not going to leave it there.

No Costings Made

In reply to questions, Mr. Langley said he had taken options on several properties but Fisons had not yet decided which they would take up. Costings had not yet been made but he was convinced that it would be an economic proposition to develop the mines. There seemed to be a plentiful supply of labour and white technicians could live at 12,000 ft. without any trouble. Although some of the potential fields were new, others had been known for some five to 20 years. The mines were privately owned by Chileans. At present Chile was exporting sulphur but it was extremely expensive. That did not mean that the sulphur they would get would be expensive. They might eventually even be able to produce at under the American price. It was all opencast mining and although workings frequently took the form of a tunnel bored into the mountainside, the longest he had seen was only 45 metres.

Transport is very primitive, Llama and aerial ropeway being the traditional methods.

Because of these austere conditions, output from the Chilean sulphur mines has been small, although the deposits are extensive. In the early war years production was increased due to the submarine menace which stimulated the demand for sulphur from neighbouring South American countries. In the six years up to 1945, Chilean production hovered around the 30,000 ton mark, but

since then it has fallen away to an annual rate of approximately 15,000 tons. The inaccessibility of the deposits has in the past prevented the industry from competing for price with the U.S. Frasch-produced sulphur. No one can estimate the extent of the deposits but one working alone is thought to contain 20,000,000 tons of ore.

Nearly thirty years ago, *The Engineering and Mining Journal* of America wrote, '. . . if the Chilean deposits were properly financed, equipped and managed, the product might successfully compete with the Gulf Coast sulphur in the markets of the Pacific Coast of the United States. The principal present interest in the Chilean deposits lies in the immense reserves and the possibility of their being some day called upon to supply the markets of the world. . . The development and large-scale exploitation of the Chilean deposits is only a question of time'.

Austrian Chemicals

Considerable Progress Made Since War

IN Austria the chemical industries account for about 10 per cent of the total industrial production, a figure somewhat below that of the leading countries. So far as raw materials are concerned she is favourably situated for chemical enterprise, and is well supplied, *e.g.*, with timber, salt, lime, gypsum and many other minerals, petroleum, and water-power. There are serious gaps, of course, and an almost complete absence of certain important branches of chemical industry, such as phosphate fertilisers, aniline dyes, sulphuric acid and its connections, photographic products, and synthetic rubber.

In an article on the subject, Dr. Hans Reif, of Vienna, points out (*Chim. et Ind.*, 1951, *65* (3), 405-407) that despite difficulties and deficits, the Austrian chemical industries have made considerable progress since the war.

Some new lines have been opened up and established ones developed. To one or other of these categories belong: electrolytic production of aluminium and magnesium, manufacture of rayon, essential oils, synthetic lubricants and other petrochemicals, nitrogenous fertilisers, alcohol sulphite cellulose residues, electrolytic alkali and chlorine, calcium carbide, etc. For the 3-year plan of 1950-52 for all industry the sum of 28.7 milliards of Austrian schillings is to be invested (800 million dollars). Of this 490 million sch. are allocated to chemical industry, the principal items in which are shown in the following table. ERP contribution to this amounts to 155.7 million sch. Figures are in 1,000,000 Austrian Sch.

Chemical	Total investment	E.R.P. share
Nitrogen fertilisers	66.6	43
Ammonium sulphate	31	15
Sulphuric acid, from gypsum	40	35
Roast phosphates and fertilisers	36.8	25.8
Superphosphates	9.7	6.2
Soda	13.7	—
Mineral pigments	16	—
Petroleum products	27	—
Tar distillation	8.1	—
Methanol	8.8	—
Electrolytic chlorine and alkali	16.3	—
Polyvinyl chloride	15	—
Calcium carbide	18.5	—
Rubber (synthetic)	52	10
Sheet viscose (or film)	45	—
Misc. improvements	28	5.3
New productions (secondary)	55.4	15.4
	487.9	155.7

In the inorganic field it is proposed to increase nitrogen fertiliser production or capacity to 90,000 tons (nitrogen) plus 95,000 tons ammonium sulphate from gypsum; sulphuric acid capacity to 70,000 tons (43,000 from gypsum and 26,000 from blende); phosphates to 100,000 tons plus 62,000 tons super; soda to 100,000 tons; and mineral pigments to 4,300 tons—from native lead and zinc ores. Organic key industries will be given special attention.

In the electrochemical field as water-power is abundant prospects are encouraging.

Synthetic Rubber Promised

THE problem of assuring to the British rubber industry adequate supplies of synthetic rubber at reasonable prices was not being allowed to lie dormant, Sir Clive Baillieu, Dunlop chairman, told the annual general meeting of shareholders on 11 June.

The advantage in cost which the growing use of synthetic rubbers gave to the North American industry might, he said, make our export position more vulnerable in the future. The great synthetic rubber industry of the United States was not only an insurance against interruption in supplies of natural rubber, it was also a national asset of real commercial value.

The Chemist's Bookshelf

AMINO ACIDS AND PROTEINS. Edited by David M. Greenberg. Charles C. Thomas, Springfield, U.S.A. Blackwell Scientific Publications, Ltd., Oxford, England, and The Ryerson Press, Toronto, Canada. 1951. Pp. 960. 99 illustrations. 110s.

This large and well produced volume is in fact a collection of no less than 13 separate books, the authorship being a co-operative effort by eighteen contributors. It is impossible to consider a book of this structure as an entity and so the separate chapters will be examined individually.

Properties of amino acids are dealt with by E. E. Howe in 53 pages, the section, including a list of references, arranged in alphabetical order. After a brief account of the nomenclature and classification of amino acids the chemical structure is examined, the section including a table of the carbon, hydrogen and nitrogen contents of amino acids. Another table giving the specific rotation of *l*-amino-acids in different solvents appears in the pages dealing with optical properties and this section has been brought up to date by means of foot notes. The chemical properties and identification of amino acids are detailed in an exhaustive and systematic manner.

Methods for the determination of amino acids are described by H. S. Olcott, in 59 pages. This subject is minutely detailed and the author gives tables of applicability of methods to amino acids, the amino acid requirements of bacteria, amino acid essay, and decarboxylation and percentage amino acid composition of proteins. The section contains a list of papers referring to microbiological assays and is complete upon the theoretical side, but could have been more valuable if more precise experimental instructions could have been included.

Chapter III is in two parts, the first being a review of the preparation of amino acids and polypeptides by S. Archer, and the second an account of the synthesis of labelled α-amino-acids by J. C. Reid and B. M. Tolbert, the whole of it occupying almost 100 pages. All of the known methods are mentioned, and often critically, but the treatment is theoretical.

A short chapter of 43 pages upon the isolation of amino acids written by M. S. Dunn and L. B. Rockland follows. The space devoted to chromatography was disappointingly small, and the subject of paper chromatography was hardly mentioned. H. L. Fevold contributed the next 56 pages on the classification, purification and isolation of proteins. This is one of the most successful chapters and has been most carefully written.

Determination of the molecular size of proteins is dealt with in 111 pages by H. P. Lundgren and W. H. Ward. This chapter is mainly devoted to a detailed discussion of the diffusion and sedimentation techniques of molecular weight determination. It is followed by a chapter contributed by the editor, D. M. Greenberg, dealing with the amphoteric properties of amino acids and interesting information in this chapter is that concerning the titration of amino acids and proteins and in particular that describing the author's methods of titrating proteins by forming an insoluble precipitate with an acidic or basic dye.

Criteria of the purity of a protein are surveyed in a critical manner by Cho Hao Li, the survey covering 45 pages. The main substance of this section is a detailed examination of electrophoretic procedures, but there is a useful sub-section which gives an account of experimental procedure for determining the solubility of proteins. Chemical reactions of proteins are discussed by H. Fraenkel Conrat in a surprisingly short chapter of only 54 pages including the literature references. The author's theoretical treatment of his subject is complete, if a little condensed, but consideration of the difficulties and techniques encountered when carrying out this rather specialised form of chemical research would have been welcome.

The remaining 4 chapters are concerned

with the biochemical aspects of the subject and contain some of the most recent and most publicised information. The nutritional applications of the amino acids are described first in a chapter of 53 pages by H. J. Almquist, and then there follows a longer and completely absorbing chapter upon the chemistry of antibodies by D. H. Campbell and F. Lanni. The first named author has been associated with much of the recent work mentioned.

Biochemical applications of proteins and peptides are dealt with in the penultimate chapter, also contributed by the editor. His review occupies 47 pages and contains some of the most sensational work in this field. In the section upon ACTH it was of especial interest to read that hydrolysates of ACTH containing only eight amino acid residues still exhibited adrenocorticotropic activity. Mention is also made of the isolation of bacterial toxins such as those from diphtheria, scarlet fever, botulinus and tetanus. Peptide antibiotics such as gramicidin and tyrocidine and virus proteins are also described and discussed. The final chapter, the longest in the book, reviews what is known about the metabolism of amino acids and proteins, and was written by H. Tarver. There is an excellent index.—J.R.M.

CHEMISCH-PHYSIKALISCHE VITAMIN-BESTIMMUNGS-METHODEN. Dr. F. Gstirner. Vol. IV. Ferdinand Enke Verlag, Stuttgart. Pp. 268. DM. 26.80.

The publication of a further edition of Dr. Gstirner's book—the fourth—after a space of nine years, must be a welcome event for those interested in the laboratory estimation of vitamins.

The aim of the book, which is kept well in mind throughout, is to provide a text giving primarily the practical details of the estimations under consideration rather than a theoretical and critical discussion of their principles or their relative merits and demerits. It is quite clear however that much critical assessment has gone to form the author's selection of methods for his book; for this is a discriminating book and one that achieves an orderly rather than an exhaustive presentation of its subject matter, each chapter being built firmly around those estimations whose trustworthiness has been well proven in practice.

A feature of special note is the frequent use of direct quotation from the original papers discussed, a fact which enhances the value of the book as an immediate aid in the laboratory.

The text has been brought up to date by the inclusion of short chapters on the estimation of pyridoxine, *p*-aminobenzois acid, biotin, vitamin K and folic acid, and it is perhaps no disadvantage to workers in this country that the references throughout should tend to show a bias towards papers published in continental journals.—F.H.M.

HETEROGENEOUS CATALYSIS: (General Discussion of the Faraday Society, No. 8). Aberdeen University Press, Ltd. Pp. 366. Price 30s.

Anyone interested in the theoretical or technical aspects of heterogeneous catalysis will find much of profit and interest in the forty-four papers collected together and published by the Faraday Society under the above title. Apart from the collected papers, the volume contains in its 366 pages some 52 pages of general discussion and it is in these pages that much of the greatest interest is to be found. The papers are grouped into four approximately equal sections: theories of adsorption and surface layers, adsorption and catalysis on metals, adsorption and catalysis on oxides, and experimental techniques.

The main problems discussed are the rather striking differences between the adsorptive properties of powders on the one hand and of evaporated films and fine wires on the other, the connection between catalytic properties and the electronic structure of the catalyst, catalytic specificity and, finally, the nature of reaction processes at solid surfaces.

One of the most striking features is the number of new experimental methods now being used in this field. Methods are described for measuring the specific heat of an adsorbed gas and the surface dipole produced on a metal surface by adsorption of a gas molecule, while other methods discussed make use of stable and unstable isotopes, small-angle X-ray scattering and electron microscopy. There can be no doubt that this discussion represents an important milestone in the development of the study of heterogeneous catalysis and that the future of these studies is, as Professor H. S. Taylor remarked in his opening address, 'both challenging and bright.'—R.S.P.

Market Reports

LONDON.—Firm price conditions are maintained in the industrial chemicals market and with production costs continuing to rise the trend is towards higher quotations. A strong demand continues in evidence in almost all sections of the market and a considerable volume of unsatisfied export enquiries is in circulation. Delivery specifications against contracts have been fully up to schedule and production generally is well sold forward. Similar conditions prevail in the coal tar products market where the scarcity of supplies for spot or near delivery is more pronounced. Naphthalene is a particularly strong market and there has been no contraction in the demand for cresylic acid. There is a substantial demand for carbolic acid.

MANCHESTER.—A general good demand for almost all classes of heavy chemical products has been reported on the Manchester market during the past week, though there are a number of lines in which considerable difficulty is being expressed in supplying the full requirements of consumers. The textile and allied trades and most other leading outlets are specifying for full deliveries under contracts and these, as well as shippers, seem anxious to place additional orders. Prices remain firm in all sections. Most descriptions of tar products, both light and heavy, are well sold forward and potential buyers are not finding it easy in a number of cases to place further orders.

GLASGOW.—The past week has more or less followed the pattern of the previous two or three weeks, with the difference that supplies are definitely becoming much easier and certain acids, chemicals and sulphurs are now free from allocation. This will most certainly have the effect of boosting up production, and the forward position generally speaking is very healthy indeed. The demand for the export market is continuing to be brisk and a steady all round trade is being done.

Portuguese Wolfram Tax

THE Portuguese Ministry of Finance has decided to raise the export duty on wolfram ore to 40 escudos (about 10s.) per kilo from the present 1½ escudos per kilo.

A Ministry spokesman told reporters that in view of this increase, the special export tax on wolfram ore of 36 escudos (9s.) per kilo, which was introduced last February, would probably be abolished. The Ministers of Economy and Finance have been discussing this matter, but no decision has yet been taken.

According to agency reports most wolfram ore exporters have suspended transactions, saying they cannot do business with these two taxes totalling 76 escudos.

The average price of wolfram ore in the Portuguese internal market is reported to be 80 escudos per kilo. Therefore, with taxes and without profit the export price would be 156 escudos per kilo, far above the 145 escudos which some importers are offering. In view of the lack of demand, most mines are not working, they say.

Russian Translations Index

AN extensive cross-index to the English translation of the *Journal of General Chemistry of the U.S.S.R.* (Vol. 19, 1949), has been published, and can be purchased separately by non-subscribers for $2.50, from the publishers, Consultants Bureau, 152 West 42nd Street, New York 18, N.Y. The cross-index contains four sections: (1) Titles of papers, listed in sequence of appearance in the journal; (2) Author index, arranged alphabetically; (3) Subject index, arranged alphabetically; and (4) Index to organic compounds, arranged according to empirical formula. Reference to the pagination of the English translation is given throughout the cross-index. The original Russian pagination is also provided in the section listing titles of papers. A similar cross-index will be published with each volume of the two Russian chemical journals now being translated by Consultants Bureau.

Change of Address

For the purpose of greater efficiency, Athole G. Allen (Stockton), Ltd., Stockton-on-Tees Chemical Works, Bowesfield Lane, Stockton-on-Tees, have changed their head office address to Tower Hill, Middleton-St.-George, Darlington, Co. Durham. The telephone number is Dinsdale 72.

The firm's associated company, Athole G. Allen (London), Ltd., Princes Wharf, 135 Grosvenor Road, London, S.W.1, will be selling agents and will invoice and receive payment for dressed and finely ground barytes and finely ground witherite.

HOME

Insecticide Officials

The following officers and executive committee will serve the Association of British Insecticide Manufacturers during 1951:—Chairman, Dr. E. Holmes (Plant Protection, Ltd.); vice-chairman, Mr. N. K. Smith (The Murphy Chemical Co., Ltd.); hon treasurer, Mr. R. V. Craven (W. J. Craven & Co., Ltd.); hon. auditor, Mr. A. G. Ponton (Pan Britannica Industries, Ltd.).

Executive committee: Mr. E. T. Bugge (Bugges Insecticides, Ltd.), Mr. R. V. Craven (W. J. Craven & Co., Ltd.), Mr. A. T. Davey (Burt, Bolton & Haywood, Ltd.), Mr. M. N. Gladstone (Pest Control, Ltd.), Mr. D. J. S. Hartt (May & Baker, Ltd.), Mr. H. J. Jones (Hemingway & Co., Ltd.).

A.B.S.C.D.M. Officers

The following officers of the Association of British Sheep and Cattle Dip Manufacturers were elected at the annual general meeting held on 24 May, 1951: Chairman, Mr. V. G. Gibbs (William Pearson, Ltd.); vice-chairman, Mr. R. Lowe (Chas. Lowe & Co. (Manchester), Ltd.; hon. treasurer, Mr. W. E. O. Walker-Leigh (Cooper, McDougall & Robertson, Ltd.); hon. auditor, Mr. R. J. Hope (Standardised Disinfectants Co., Ltd.); and secretary, Mr. W. A. Williams, M.B.E., B.Sc.

The following were elected to the executive committee: H. W. Barker (Battle Hayward & Bower, Ltd.), R. J. Hope (Standardised Disinfectants Co., Ltd.), R. W. Lowe (Chas. Lowe & Co. (Manchester), Ltd.), W. M. Macmillan (Robert Young & Co., Ltd.), D. O. Marshall (Osmond & Sons, Ltd.), A. S. Roxburgh (Roxburgh Morgan & Co., Ltd.), and H. O. Waller (Cooper, McDougall & Robertson, Ltd.).

Ardeer Explosion

Two men—D. MacManus and Andrew Reid—were killed and a number of girls suffered from shock as a result of an explosion which occurred on Wednesday of last week at the I.C.I. factory, Ardeer, Stevenston. The cause of the explosion is unknown, but it is believed that a bogie carrying explosives blew up as the two men were pushing it along a track which winds through the factory. The two men were both married, and Reid was the son of Mr. Ernest Reid, a foreman at the factory, who was at work at the time of the explosion.

S.V.S. Brains Trust

The B.B.C. European Service is holding a Brains Trust at the Society for Visiting Scientists on Wednesday, 20 June, at 8 p.m. Questions will be discussed by J. S. Huxley, D.Sc., F.R.S., E. C. Bullard, Sc.D., F.R.S., Lindley Fraser, M.A, Ph.D., and Paul Bareau, B.Com. S.V.S. members are warmly invited to be the audience at this Brains Trust and to submit questions calculated to arouse interesting discussion; these should be sent by 16 June to the Assistant Secretary, who will broadcast a day or two later to an audiance of a general character. The questions should concern general principles rather than scientific detail. In addition, a few questions of a lighter type will be very welcome.

Opportunity will be given to the questioner to make his points during the discussion of the question he has put, though he is expected to be very brief.

Silicated Ash

We have received an inquiry from a Johannesburg firm who wishes to contact British manufacturers of 'Silicated Ash'. This is a reaction product of sodium silicate and soda ash, containing unreacted sodium carbonate and a silicate thought to be in the form of a glass, since no crystalline silicate is disclosed when examined by X-ray diffraction. Will any firm in a position to supply this material please contact the editor of THE CHEMICAL AGE.

Cabot Carbon

Cabot Carbon, Ltd., is to build a further carbon black unit at Ellesmere Port which should result in a total annual capacity of 40 million lb., doubling present production. The company is the wholly-owned subsidiary of Godfrey L. Cabot, Inc., of Boston, and was the first American overseas investment guaranteed by ECA under the Marshall Plan. Any additional financing required will be provided by the American parent.

It is stated that this expansion should save Britain over $1,000,000 annually.

OVERSEAS

Big Uranium Development

The development of the largest uranium field yet discovered in the North American continent has begun at Beaver Lodge Lake in Saskatchewan. It is expected to yield five times as much uranium ore as the mine at Great Bear Lake, in Canada's North-West Territory, hitherto the only producer on a commercial scale in Canada. The aim is to produce 500 tons daily, but it is hoped to double and even triple this figure. A mill with a 500-ton capacity will be built with a view to its being expanded to 2,000-ton capacity if necessary.

To Control Scarce Exports

Trade in Argentine-produced beryllium, mica and tungsten has been placed under government control by a decree which emphasises the industrial importance and international scarcity of these minerals. The decree declared that it was desirable to encourage production and build up reserves. Henceforth, domestic marketing of beryllium, mica and tungsten will be exclusively through the Argentine Industrial Credit Bank, to which producers must sell their output. Exports of these products will be made through the Instituto Argentino de Promoción del Intercambio.

Pyrites Development in Brazil

President Vargas has approved the plans of the Finance Minister for the development of a sulphur industry in Brazil, using as raw material the pyrites reserves, estimated at 500,000 tons, of the Cia. Siderurgica Nacional at Tubarao in the State of Santa Catarina. The Minister pointed out that Brazil's annual sulphur requirements are about 70,000 tons, compared with 45,000 tons at present being received from the United States. He suggested that a new corporation, 50 per cent of which would be owned by the Cia. Siderurgica Nacional and the remaining 50 per cent by private interests, should be formed to develop the Tubarao reserves.

Catalysts in Tablet Form

Special industrial presses are now being made by F. J. Stokes Machine Company, Philadelphia, Pa., for the production of catalysts and catalyst supports in tablet form. The tabletting presses are similar to those used for the production of aspirin. Tabletted catalysts as small, uniform particles can control the reaction speed more critically as well as provide an improved surface-to-mass ratio, necessary in certain types of catalytic reactions, than previously used irregular mases. Since almost all catalysts are either elemental metals or their oxides, it is not always possible for the oxide to adhere to the parent metal and form a powder as such. It therefore becomes necessary to form them into some shape, as a tablet. Tabletting rates of as high as 4,000 per minute are possible with the machines.

Canadian Chemicals Expand

Canada's leading chemical manufacturers plan a $150,000,000 expansion programme this year. Among projected developments are: North American Cyanamid has started spending $5,000,000, of which $4,000,000 will be on its Niagara Falls chemical and Welland fertiliser plants, connected principally with making propellants. $1,500,000 is scheduled to be spent on a new plant in Montreal to be ready by 1952, for making pharmaceuticals previously imported from the U.S. A new chemical company has been formed to build and operate a $3,000,000 plant in Northern Alberta mainly for making caustic soda and chlorine. Canadian Chemical Co. (Columbia Cellulose) plans a $40,000,000 petrochemical plant near Edmonton; Canadian Industries, Ltd., will build a $4,000,000 explosives plant at Calgary, and a $1,500,000 liquid SO_2 plant at Copper Cliff as well as polythene and nylon intermediate plants.

More Canadian Chemical Plants

The Consolidated Mining and Smelting Company of Canada has recently announced that it is going to build a $9,000,000 fertiliser plant at Kimberley, B.C. In addition, Dominion Tar & Chemical Co. are planning to erect a $7,000,000 plant for the manufacture of ethylene glycol and associated chemicals, at Montreal East, as well as a $1,600,000 phthalic anhydride plant at Toronto. The Aluminium Company of Canada have also announced the expenditure of some $1,500,000 to double the SO_2 capacity of their plant at Arvida, Quebec.

Publications & Announcements

THE 24th Sir Jesse Boot Foundation Lecture, delivered on 2 February, 1951, is now available in pamphlet form from the Registrar, Nottingham University. Given by Professor J. H. Burn, M.A., M.D., F.R.S., this lecture was on the formation of adrenaline in the body. Decarboxylated phenylalanine has long been supposed to be the natural precursor of adrenaline in the body, and evidence of its conversion into the related amino-acid tyrosine, as well as tracer evidence, supports this quite well. However the insertion of the β-hydroxyl group in adrenaline presents some difficulty, and the mechanism may as well be condensation of two tyrosine molecules as in the formation of thyroxine, since radio elements have been found to transfer, sometimes, to neighbouring molecules. The simplest route that has been suggested from tyrosine is through tyramine, but Professor Burn is doubtful about this mechanism and concentrates on discussing the conversion of tyrosine into dihydroxyphenylalanine; decarboxylation; the introduction of a β-OH group; and the methylation of *nor*adrenaline.

* * *

VOLUME I, number 3, of the Colonial Geology and Mineral Resources (HMSO, 5s.) for 1950 has recently become available. The first article takes for its subject the geology and mineral resources of Mauritius. An essentially volcanic island, Mauritius minerals in economic concentrations are scarce, although certain secondary products provide potential economic resources—the corals and clays should, for example, be capable of yielding Portland cement, and iron ore has been reported in workable deposits, although not confirmed.

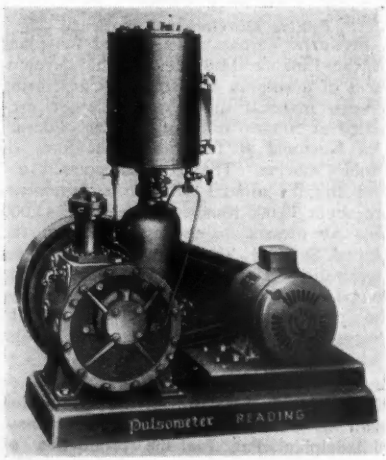
The production of chrysotile asbestos in dolomite from Bechuanaland is described in a second article in the survey, summary reports are appended on Nigeria, Gold Coast, Uganda, Kenya, Jamaica and other territories, and there is an account of the laboratory investigations of the Mineral Resources Division on iron and titanium ores from the Bukusu Hill Alkaline Complex of Uganda. Notes and abstracts cover the bauxite resources of Jamaica and the coal and lignite resources of Nigeria, and other subjects.

HIGH vacuum is necessary for a large number of industrial operations; much interest attaches, therefore, to the latest designs of the 'Geryk' 1-in./50 single-stage type rotary vacuum pump, a production of the Pulsometer Engineering Co., Ltd., of Reading. This firm has been making vacuum pumps for over 40 years and has a wide range of machines available, with duties up to 250 cu. ft. free air per minute displacement, giving a high degree of vacuum and fast pumping speed with the minimum of power.

The 8-in/50 type is specially intended for general industrial use and is a compact single-stage water-jacketed pattern built for hard wear at low cost for factory use.

The normal duty is 60 cu. ft. of free air or gas per minute swept through, running at 350 revs. per minute, taking not over 3 H.P. The vacuum obtained is 0.005 mm. off perfect on a closed dry circuit.

Automatic internal lubrication is provided so that all rotating parts run continuously in a film of oil, while the rotor has roller bearings, and the flywheel pulley runs on a trunnion drive, which takes all drive strain from the pump shaft and reduces gland trouble to a minimum.



'Geryk' Rotary Vacuum Pump

splitting fats

the continuous way

—after three years of research work another process graduates from BAMAG'S Pilot Plant Station.

• up to 98/99% true split • at least 40% glycerine in sweetwater • completely automatic operation • no catalyst used • suitable for most oils and fats • highest quality fatty acids obtained • plant available in standard sizes

Write for further information to the Oils & Fats Division of

BAMAG LIMITED

The Chemical Engineers for Complete Installations

Rickett St., London, S.W.6. Phone: Fulham 7761. Cables: Bamag, London

45/1.

· PERSONAL ·

DR. D. B. FOSTER, M.I.Mech.E., F.Inst.F., A.M.I.Chem.E., has joined Mullard, Ltd., as chief engineer of the Equipment Division. He has also been appointed executive director of Mullard Equipment, Ltd., the subsidiary company which manufactures scientific and telecommunication equipment.

Dr. Foster studied electrical engineering at King's College, London University. From 1929 to 1936 he was with the Western Electric Co., Ltd., on the development of electronic instrumentation in the field of acoustics, and from 1936 to 1942 he was with Vauxhall Motors, Ltd.

In 1942 Dr. Foster joined the British Coal Utilisation Research Association as Assistant Director where he was engaged in wartime work on fuel-saving and the production of new raw materials from coal.

In 1944 he was transferred to the Powell Duffryn organisation as the first general manager of their London Research laboratories and took a leading part in the development and commercial production of new technical carbons for the electrical, mechanical and chemical industries. He was appointed a director of Powell Duffryn Carbon Products, Ltd., in 1950.

Dr. Foster brings to his new position an all-round knowledge of research and development administration in the fields of engineering, physics and chemistry together with experience of production and works organisation.

Liverpool University is to confer the honorary degree of LL.D. on PROFESSOR HUGH STOTT TAYLOR (David B. Jones Professor of Chemistry at Princeton University, U.S.A.), at the mid-summer degree day ceremonies at the Philharmonic Hall, Liverpool, on 7 July. He was awarded this degree last year, but was unable to be present and the conferment was postponed.

Born at St. Helens in 1890, Professor Taylor won the David Gamble scholarship at Liverpool University in 1906. He gained his B.Sc. first-class (honours chemistry) and the Sheridan Muspratt scholarship for post-graduate work. From Liverpool, where he was admitted a Doctor of Science in 1914, he went as a junior professor to Princeton University, and later became senior professor of physical chemistry.

PROFESSOR E. K. RIDEAL, M.B.E., M.A., D.Sc., F.R.S., F.R.I.C., has received a knighthood in recognition of his service to science. In the King's Birthday Honours List published on 7 June it was disclosed that he had been created a Knight Bachelor. MR. ROGER DUNCALFE, chairman of the General Council, British Standards Institution and chairman of British Glues & Chemicals, Ltd., received a similar honour.

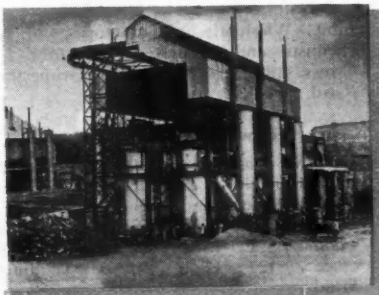
Professor Rideal is professor of physical chemistry, King's College, London, and president of the Chemical Society. He is a past president of the Faraday Society and of the Society of Chemical Industry and a past chairman of the Chemical Council.

Mr. Duncalfe is a vice-president of the Association of British Chemical Manufacturers.

The following awards were also included in the List: H. E. WATTS, M.B.E., G.M., F.R.I.C., H.M. Chief Inspector of Explosives, Home Office—Companion of the Order of the Bath; W. K. SLATER, D.Sc., F.R.I.C., secretary, Agricultural Research Council—Knight Commander, Order of the British Empire; G. F. EARLE, chairman and a managing director, Associated Portland Cement Manufacturers, Ltd.—Commander, Order of the British Empire; F. Y. HENDERSON, D.Sc., director, Forests Products Research Laboratory, DSIR—Commander, Order of the British Empire; H. HOLLINGS, D.Sc., F.R.I.C., Controller of Research, North Thames Gas Board—Officer, Order of the British Empire.

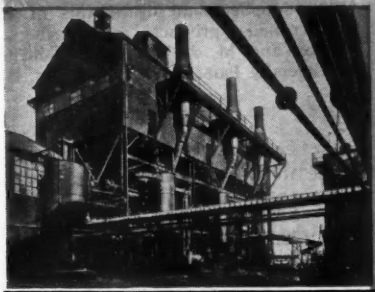
THE DESIGN & MANUFACTURE OF PLANT

FOR THE PRODUCTION, COOLING, PURIFICATION & PROCESSING OF INDUSTRIAL GASES



A six unit P.G. Producer Gas Plant gasifying wood logs.
INDIA

A four unit P.G. Semi Water Gas Plant using Oxygen and gasifying coke.
HOLLAND



A three unit P.G. Semi Water Gas Plant gasifying coke.
SOUTH AFRICA

THE POWER-GAS CORPORATION LTD.
ASSOCIATED WITH
(ASHMORE, BENSON, PEASE & CO., LTD.)
STOCKTON-ON-TEES AND LONDON
AUSTRALIA CANADA INDIA SOUTH AFRICA

Commercial Intelligence

The following are taken from the printed reports, but we cannot be responsible for errors that may occur.

Mortgages and Charges

(Note.—The Companies Consolidation Act of 1908 provides that every Mortgage or Charge, as described herein, shall be registered within 21 days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every company shall, in making its Annual Summary, specify the total amount of debt due from the company in respect of all Mortgages or Charges. The following Mortgages or Charges have been so registered. In each case the total debt, as specified in the last available Annual Summary, is also given—marked with an *—followed by the date of the Summary, but such total may have been reduced.)

CHEMICAL MANUFACTURERS DISTRIBUTORS CORPN., LTD., London, E.C. (M., 16/6/51). 3 April, series of debentures for £16,875 together with a premium of 33⅓ per cent present issue £4,275; general charge. *Nil. 12 December, 1950.

GRIMSHAW BROTHERS & Co., LTD., Manchester, chemical manufacturers, etc. (M., 16/6/51). 3 April, mortgage, to Midland Bank, Ltd., securing all moneys due or to become due to the bank; charged on land and buildings at Croft Street, Clayton, Manchester, with fixtures, etc. *Nil. 18 August, 1950.

Satisfactions

CLASSIC CHEMICALS, LTD., Radcliffe. (M.S., 16/6/51). 10 April, of charge registered 5 November, 1946, to the extent of £2,000; also satisfaction 10 April. £4,945 14s. 1d. registered 1 February, 1950.

J. W. ROGERS (CHEMISTS), LTD., Reading. (M.S., 16/6/51). Satisfaction, 26 March, of charge registered 10 April, 1945.

Receivership

ESCADE, LTD., 51 Hadrian Road, Newcastle-on-Tyne, 4. Mr. W. A. Whitehead, Martins Bank Chambers, 123/5 Clayton Street, Newcastle-on-Tyne, 1, was appointed receiver and manager on 1 May, 1951, under powers contained in debenture dated 30 January, 1951.

New Registrations

Emlyn Williams (Chemists), Ltd.

Private company. (496,106). Capital £1,000. Wholesale or retail consulting, analytical, manufacturing, pharmaceutical and general chemists. Directors: G. L. Williams and E. Roberts. Reg. office: 3 Queen's Road, Llandudno.

Ronald Davidson (Chemists), Ltd.

Private company. (496,027). Capital £100. Wholesale and retail consulting, analytical, manufacturing, pharmaceutical and general chemists. Directors: R. I. Davidson and Mrs. H. Davidson. Reg. office: 75 Kingsland High Street, E.8.

Jenners (Chemists), Ltd.

Private company. (496,159). Capital £100. Wholesale, manufacturing or retail chemists and druggists. Director: J. E. Crowe. Reg. office: 880 Grimesthorpe Road, Sheffield 4.

Harwood & Hall, Ltd.

Private company. (495,924). Capital £500. Consulting, analytical, manufacturing, pharmaceutical and general chemists, etc. Directors: E. M. Harwood, A. R. Harwood, P. E. Hall and H. Hall. Reg. office: 122 High Street, Teddington, Middx.

J. F. Macfarlan & Co., Ltd.

Private company. (496,002). Capital £125,000. Research and manufacturing chemists, importers, exporters and manufacturers of and dealers in pharmaceutical, medicinal, chemical, industrial and other preparations, articles and compounds, etc. Directors: D. R. Brown, N. R. Brown, F. J. Bolton, R. H. Mathew. Reg. office: 8 Elstree Way, Boreham Wood, Herts.

Petrochemicals (Sales), Ltd.

Private company. (496,193). Capital £100. Suppliers and distributors of crude oil, petroleum products. Subscribers: F. Hopton and M. J. Wordley. Solicitors: Linklaters & Paines, 6 Austin Friars, E.C.2.

Increases of Capital

The following increases of capital have been announced: GARTH & BROWN, LTD., from £2,000 to £10,000; SOZOL (1924), LTD., from £20,000 to £40,000.

Change of Name

The following change of name has been announced: BOWDLER & BICKERDIKE, LTD., to H. E. J. CORY, LTD.

Next Week's Events

MONDAY 18 JUNE

British Standards Institution

London: Science Museum, South Kensington. BSI Exhibition 10 a.m. to 7 p.m. daily until 28 June.

THURSDAY 21 JUNE

Incorporated Plant Engineers

Liverpool: Radiant House, Bold Street, 7 p.m. Lecture: 'Feedwater Treatment'.

The Royal Society

London: Burlington House, Piccadilly, W.1, 4.30 p.m. Bakerian Lecture by Professor E. K. Rideal, F.R.S.: 'Reactions in Monolayers'.

New Titanium Deposits

The Dominion of Canada's Department of Mines has begun an immediate study of the discovery of titanium ore near Montreal. Although no specific information has been given as to the location of the find it is known that the proximity of the deposits to rail facilities gives the discovery special importance.

FOR LIQUIDS OF EVERY CONSISTENCY
MITCHELL
RAPID MIXING & STIRRING UNITS
For mixing liquids of every consistency, you need a mixer that is adaptable and versatile. We can fulfil both these requirements, and from our wide range, there is sure to be one for your particular job. Why not consult us?
The illustration shows a portable mixing unit, clamped to the side of a tank in a chemical works.
L. A. MITCHELL LIMITED
17 PETER STREET · MANCHESTER 2
M.X.37

JMS

ANHYDROUS SODIUM SULPHATE

HIGH QUALITY MATERIAL

LOW IRON CONTENT

INCREASED SUPPLIES

Now Available

For Sample and Quotation apply

J. M. STEEL & CO. LTD.

Dept. B/5

KERN HOUSE, 36-38 KINGSWAY, LONDON, W.C.2 HOLborn 2532/5

Branch Offices:

51, SOUTH KING STREET, MANCHESTER, 2. Deansgate 6077/9

45, NEWHALL STREET, BIRMINGHAM, 3 Central 6342/3

CLASSIFIED ADVERTISEMENTS

SITUATIONS VACANT

A number of vacancies exist for **MALE LABORATORY ASSISTANTS.** Higher Schools certificate or Matriculation, with some laboratory experience. Age 20-25. Starting wage £4 10s. to £7 15s. per week, according to age, qualifications and experience. Applications to **Laboratory Manager, The Fullers' Earth Union Ltd., Copyhold Works, Redstone Hill, Redhill, Surrey.**

CHEMICAL ENGINEER. Well known and expanding Anglo-American engineering and contracting firm in City of London requires Chemical Engineer with Honours Degree or its equivalent, together with some refinery and/or industrial experience. The position presents excellent prospects for candidate possessing, in addition to the required academic qualifications and experience, the ability to express his thoughts and ideas both orally and in reports, and a keen desire to keep abreast of latest developments in this profession, both theoretically and practically. Good starting salary commensurate with qualifications and age. Write in strict confidence giving full details of education, qualifications, experience, age and present salary, to **Box Z.D. 399, Deacon's Advertising, 36 Leadenhall Street, London, E.C.3.**

CHEMIST or **CHEMICAL ENGINEER** with works experience required for the design and development of glass Chemical Plant. Duties will include co-operation with customers on matters of design, erection and operation, as well as carrying out design and development work in the factory. **Apply Technical Director, Quickfit & Quartz Ltd., Stone, Staffs.**

FULLY qualified **ENGINEER** required for the control of a large design office in London by an Anglo-American engineering firm engaged upon the design and construction of large chemical plants in the United Kingdom and Europe. Applicants must have had extensive drawing office experience in the co-ordination of mechanical, electrical and civil engineering work. A knowledge of chemical engineering is desirable. B.Sc., degree or equivalent essential, and full membership of appropriate Professional Institution desirable.

The post offers scope for considerable further advancement and the starting salary will depend upon qualifications and experience. Write, in confidence, giving details of education, qualifications, experience, age and present salary to **Box No. 67, c/o Browns, 37, Tothill Street, S.W.1.**

SERVICING

ALL CHEMICALS AND DYESTUFFS can be repacked for export by **The East London Chemical Warehouse Co. Ltd., New Barn Street, Abbey Arms, Plaistow, London, E.13.**

CRUSHING, GRINDING, MIXING and DRYING for the trade.
THE CRACK PULVERISING MILLS, LTD
49/51, Eastcheap, E.C.3
Mansion House, 4406.

"DOHM LTD., PULVERISING," raw materials everywhere, 167, Victoria Street, London, S.W.1.

GRINDING of every description of chemical and other materials for the trade with improved mills. **THOS. HILL-JONES, LTD., "Invicta" Mills, Bow Common Lane, London, E. Telegrams: "Hilljones, Bochurch, London," Telephone: 3285 East.**

FOR SALE

VARIOUS MIXERS FOR SALE

BAND CONVEYOR, 50 ft. long 40 in. wide, steel frame motorised, for boxes, cases, bags, etc.

A FILTER PRESS, 31½ in. square, fitted with 42 C.I plates, centre fed.

1½, 2½ and 3½ size belt-driven DISINTEGRATORS by Christy & Norris or Harrison Carter.

Size No. 3 Junior Hammamac HAMMER MILL with fan and cyclone, also No. 1 size Miracle **GRINDING MILLS** and one size 3W Miracle **GRINDING MILL.**

Robinson 3-sheet No. 1 size **CENTRIFUGAL DRESSING MACHINE** for dry powders, etc.

Gardner Size "G" **RAPID SIFTER** and **MIXER,** belt and gear driven.

Two Gardner **RAPID MIXERS** only, 40 in. long, 14 in. wide, one provided with small separate A.C. Motor.

Four **ROTARY BOWL MIXERS,** 5 ft. diam., cast iron built, inclined agitators, by Baker Perkins.

One Broadbent under-driven **HYDRO EXTRACTOR** self-balancing type, with self-contained A.C motor.

Two **FILTER PRESSES,** fitted recessed C.I. plates, 40 in square, 2½ in. thick, centre fed, to make 11 cakes per Press.

One Lilleshall **FILTER PRESS,** fitted 18 C.I. plates, 36 in square, and 19 C.I. frames, with side inlet, side enclosed delivery and usual fittings.

Kek **GRINDING MILL,** square pin type, with grinding discs 13 in. diam., including circular delivery bin with single outlet.

Large unjacketed **WERNER MIXER,** belt and gear driven, hand tipping, double "Z" arms, pans 53 in. by 45 in. by 36 in. deep.

No. 200 One nearly new **WERNER PFLEIDERER JACKETED MIXER OR INCOPORATOR.** Low type, with C.I. built mixing chamber, 28 in. by 29 in. by 27 in. deep, with double "U"-shaped bottom which is jacketed, and double fish-tail or fin-type agitators geared together at one side, with belt-driven friction pulleys, 34 in. diam. by 5 in. face, with hand-wheel operation and hand-operated screw tilting gear. Machine fitted with machine-cut gears covers, gear guard, cast-iron baseplate, and measuring overall approximately 7 ft. by 6 ft. by 4 ft. high to the to of the tipping screw.

No. 209 One **HORIZONTAL "U"-SHAPED MIXER,** steel built, riveted, maesuring about 8 ft. 3 in. long by 3 ft. wide by 3 ft. 3 in. deep, with horizontal shaft, fitted with bolted-on mixing arms about 18 in. long by 4 in. wide, with intermediate breakers, and driven at one end by a pair of spur gears, with countershaft, fast and loose belt pulleys, outer bearing and plug cock type outlet at the opposite end, mounted on two cradles fitted to two R.S.J. running from end to end.

Further details and prices upon application

Write RICHARD SIZER LIMITED, ENGINEERS CUBER WORKS, HULL

FOR SALE

600

CHEMICAL PLANT

TWIN pot type **PEBBLE MILL** with two 2 gal. containers. Motorized 400/3/50. Grinding media included.

2 steam jacketed **ROTARY VACUUM DRYERS,** each 17 ft. 3 in. by 4 ft. 6 in. diam. Manhole in barrel with cover. Mounted on roller tracks and driven through glanded trunnion bearings. Discharge through S.J. chamber.

TWIN ROLL FLAKING M/C by Bertram, with C.I. rolls 60 in. by 28 in. diam. Drive through helical gearing from 4 ½-h.p. reduction gear box ratio 160-35. Rolls suitable for 40 lb. pressure.

TUNNEL KILN by Incandescent Heat Co. Effective length 104 ft. 11 in. Overall length of Pusher Gear, etc. 130 ft. Three zone temperature control with Foster Instrument Panel, Pusher Gear Fans, trunking, etc. Arranged for gas firing, suitable max. temperature 1400°C. Working width tunnel 3 ft. 10 in. Including 32 bogies.

2 vert. cyl. **MIXERS,** 3 ft. diam by 6 ft. 8 in. deep, on straight with 9 in. cone bottom to 2 in. diam. outlet. Vert. shaft, propellor type agitators. 2½ in. o.d. int. steam coils. Vessels T/E. flat bolted cover with 3 in. and two 1 in. connections. 15 in. diam. manhole in side.

Horizontal single trough **STEAM JACKETED MIXERS** by Scott. 14 in. long by 4 ft. 6 in. deep by 4 ft. 6 in. wide. Of rivetted M.S. W.P. 50 lb. sq. in. Totally enclosed with 24 in. by 18 in. manhole in cover. F. and L. pulley drive, through worm gearing.

Horizontal **TROUGH MIXER** 18 in. by 19 in. by 25 in. deep with gate type agitator. Hand tilting. Motorized 400/3/50.

2 **FILTER PRESSES** by S. H. Johnson. Plate and frame type, 69 chambers forming cakes 33 in. sq. Individual plate discharge. Hand op. closing gear.

GEORGE COHEN SONS & CO., LTD.,
SUNBEAM ROAD, LONDON, N.W.10.
Tel.: Elgar 7222 and
STANNINGLEY, NR. LEEDS,
Tel.: Pudsey 2241.

CHARCOAL, ANIMAL and VEGETABLE, horticultural, burning, filtering, disinfecting, medicinal, insulating; also lumps ground and granulated; established 1830; contractors to H.M. Government.—THOS. HILL-JONES, LTD., "Invicta" Mills, Bow Common Lane, London, E. Telegrams, "Hilljones, Bochurch, London." Telephone 3285 East.

DISINTEGRATOR 'Devil' disc type 20-in. diam. **TABLET PRESSES** rotary and single-punch.
MIXER 30 in. diam. by 30 in: deep horizontal shaft.
MIXER by Baker-Perkins twin Z-arm beaters.
Rotary geared **VISCOSE PUMP** 4-in. outlet.
Copper Melting **PAN,** 24 in. diam. by 15 in. deep.
Duplex Worthington Steam **PUMPS.**

WELDING'S, SAXONE BDGS.,
TARLETON STREET., LIVERPOOL, 1.

NORTHEY-Boyce Twin Rotary **DRY VACUUM PUMP,** 180 c.f.m. or 364 c.f.m. series or parallel running, mounted on bedplate.
Several Lacy-Hulbert **VACUUM PUMPS,** from size 0.
Vertical Egg-ended **PRESSURE VESSELS,** 5 ft. by 12 ft. 6 in. 100 lb. p.s.i., ½ in. plate.
Unused Baird & Tatlock, 8 gallon **REFRACTIONATING VACUUM STILL.**

REED BROTHERS (ENGINEERING) LTD.,
REPLANT WORKS, CUBA ST.,
MILLWALL, E.14.
'Phone: **EAST** 4081

FOR SALE

MORTON, SON & WARD LIMITED
—OFFER—
the following

THREE 200g stainless steel rectangular **TANKS,** new and unused.
TWO 60 g and ONE 50g Stainless Steel jacketed **BOILING PANS,** can be arranged with mixing gear.
TWO 100g mild steel jacketed **BOILING PANS.**
'Morward' **TROUGH MIXERS,** 4 ft., 6 ft. and 8 ft., arranged with scroll type mixing gear, electrically driven or fast and loose pulley, hand wheel operated discharge.
2 in. Drysdale PUMPS, all gun metal, stainless steel shafts, 2,000 g.p.h. at 50 ft. head.
TWO 6 in. acid resisting cast steel non clog, Slurry type **PUMPS,** direct coupled to electric motor, mounted on common bedplate, 10,000 g.p.h. at 150 ft. head.
Numerous sizes all bronze, brass tube **CONDENSERS** and **HEAT EXCHANGERS.**
HYDRO EXTRACTORS. A large selection from 72 in. to 30 in. all electric.
Several Hopkinson's **CENTRIFUGES** for separating in stock.

MORTON, SON & WARD, LIMITED,
WALK MILL,
DOBCROSS, NR. OLDHAM,
Lancs.
'Phone: Saddleworth 437.

FOR SALE
EXCELLENT STORAGE VESSELS

ONE 28 ft. by 8 ft. diam. welded, dish ended. Shell 5/16 in. ,dish ends ⅜ in. Capacity 8,500 galls.
One 28 ft. by 7 ft. 6 in. diam. rivetted, dish ended. Plate ⅜ in. Capacity 8,000 galls. Immediate delivery.
Inspection here:
MADEN & McKEE, LTD.,
317 PRESCOT ROAD LIVERPOOL 13

PHONE 98 STAINES

"WERNER Pfleiderer" twin-blade Jac. **TIPPING MIXERS,** 29 in. by 27 in. by 19 in. and 25 in. by 25 in. by 20 in. deep.
" Gardner **POWDER MIXERS,** 6 ft. by 2 ft. by 2 ft. 3 in. and 5 ft. by 1 ft. 7 in. by 2 ft. deep.
Three R.S. Jac. **AUTOCLAVES,** 6 ft. by 3 ft. diam. approx.
Cyl. Steel Vert. **MIXER,** 6 ft. deep by 3 ft. 6 in. diam.
Jac. Enc. Oval **MIXER,** 6 ft. by 4 ft. by 4 ft., with twin vert. mixing arms.
Twin " Z " blade **TIPPING MIXERS,** 43 in. by 40 in. by 28 in. and 30 in. by 28 in. by 21 in.

HARRY H. GARDAM & CO., LTD.,
STAINES

3 M.S. Welded Jacketed **PANS,** 24 n. diam by 26 in. deep, 1½ in. bottom outlet, mounted on angle legs. Tested 100 lb. hydraulic pressure.

THOMPSON & SON (MILLWALL) LIMITED
CUBA STREET, LONDON E.14.
Tel.: East 1844

MORTON, SON & WARD, LIMITED
—OFFER—
6-in. **STEEL PIPING,** approx. 400 ft. in 20 ft. lengths, screwed and flanged, also bends. As new.

MORTON, SON & WARD, LIMITED,
WALK MILL,
DOBCROSS, NR. OLDHAM,
Lancs.
'Phone: Saddleworth 437

8 COPPER-jacketed **MELTING PANS,** 18 in. diam. by 12 in. deep, fitted covers, mounted in M.S. frames 25 in. by 25 in. by 44 in. high, with flanged fittings, valves and steam traps. As new.

THOMPSON & SON (MILLWALL) LIMITED
CUBA STREET, LONDON, E.14.
Tel. East 1844

FOR SALE

24 STEEL VESSELS ALL WELDED. Vertical 5 ft. by 3 ft. 6 in. by $\frac{1}{16}$ in. plate Concave and Convex.

MADEN & McKEE, LTD.,
317, PRESCOT ROAD, LIVERPOOL, 13.

WORKING NOTICE

THE Proprietor of British Patent No. 481100, entitled **"PROCESS FOR SEPARATING SOLUBLE AND VALUABLE CONSTITUENTS FROM SYLVINITE ORES AND PRODUCT OR PRODUCTS OBTAINED THEREBY,"** offers same for license or otherwise to ensure practical working in Great Britain. Inquiries to **Singer Stern & Carlberg, 14 E. Jackson Boulevard, Chicago, 4, Illinois, U.S.A.**

PATENTS & TRADE MARKS

KING'S PATENT AGENCY, LTD. (B. T. King, A.M.I.Mech.E., Patent Agent), 146a, Queen Victoria Street, London, E.C.4. ADVICE Handbook, and Consultation free Phone: City 6161.

HYDROGEN PEROXIDE

Concentrated Qualities Dyestuffs & Chemicals

COLE & WILSON, LTD.
24, Greenhead Road, HUDDERSFIELD
Phone: Huddersfield 1993. Grams: 'Colour' Huddersfield

Calcium Chloride

Flake 76/80%
Solid fused 72/75%

Quantities of
up to 20 tons available
for despatch within 3/4 weeks
from receipt of order.

G I SERVICES

A Harris & Dixon Company
Guest Industrials Ltd.
Raw Materials Division
81, Gracechurch Street, London, E.C.3
Telephone: Mansion House 5631 (16 lines)
Telegrams: Guestind, London

J. F. Farwig & Co
LIMITED Est. 1809

IMPERIAL DOUBLE SEAMED SQUARE
Cans fitted with various types of necks, ranging from $\frac{1}{4}$ pint to 1 gallon capacity.

R.D. CONTAINERS
The fullway opening lever container comprising a special fitting plug easily removed, with a tabbed capsule covering to ensure a perfect sealing.

208/214 YORK ROAD, BATTERSEA, LONDON, S.W.11.
Telephone Battersea 7008 *Telegrams Calorigen, Batt, London*

HYDROFLUORIC ACID

ANHYDROUS AND SOLUTIONS ALL STRENGTHS
ALSO PURE REDISTILLED 40% w/w

FLUORIDES, Neutral
Sodium, Magnesium, Barium, Potassium, Lead, Zinc, Ammonium, Aluminium Lithium, Chromium.

BiFluorides (Acid)
Ammonium Sodium, Potassium.

Double Fluorides (Cryolites)
Sodium HexafluoAluminate
Potassium HexafluoAluminate

SILICOFLUORIDES
Magnesium, Zinc, Ammonium, Barium, Potassium, Lead, Hydrofluosilicic Acid.

BOROFLUORIDES
Sodium, Potassium, Ammonium, Lead, Copper, Zinc, Cadmium, Fluoboric Acid Solution.

OTHER FLUORIDES TO SPECIFICATIONS.

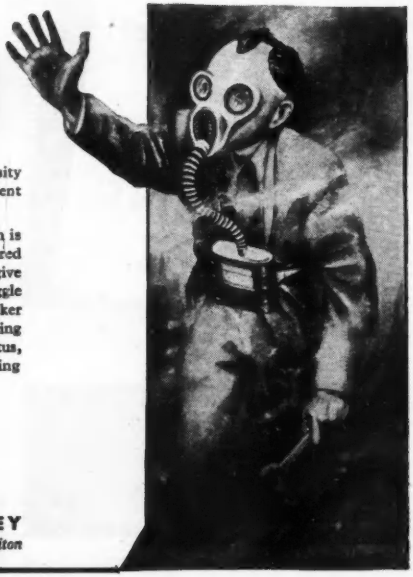
Glass Etching Acids

Ammonia White Acid and VITROGRAPHINE.

JAMES WILKINSON & SON, LTD.

TINSLEY PARK ROAD, SHEFFIELD, 9
Phone 41208/9 'Grams "CHEMICALS" Sheffield

PROTECTION



IN Chemical Works, Refrigerating Plants, etc., the necessity for dealing with gas escapes and repair work calls for efficient protection of the men on the job.

This is provided by the "PURETHA" Respirator, which is comfortable, efficient and simple. Its canisters are coloured according to the gas or group of gases against which they give protection. Full mask and mouthpiece, nose-clip and goggle types. All other protective devices for the industrial worker also manufactured and supplied: Self-contained breathing apparatus, smoke-helmets, short-distance fresh-air apparatus, resuscitating apparatus, dust masks, protective clothing goggles, etc.

SIEBE GORMAN & CO. LTD
LONDON
EVERYTHING FOR SAFETY EVERYWHERE

TOLWORTH, SURBITON, SURREY
Telephone: Elmbridge 5900 *Telegrams: Siebe, Surbiton*

Lennox Foundry Co. Ltd.

Specialists in non-ferrous Castings for the Chemical Industry

Glenville Grove, London, S.E.8

The NEW Emulsifiers and Stabilisers

Polyoxy ethylene glycol oleates 200-6,000
Polyoxy ethylene glycol stearates 200-6,000 for DDT, toxaphene and other Insecticide emulsions.

WATFORD CHEMICALS

WATFORD CHEMICAL CO. LTD.
22/32 Copperfield Road, London, E.3 Tel: Advance 2604/6

"ZULO"

CARBOY HAMPERS

LEIGH & SONS METAL WORKS
Orlando St
BOLTON

KEEBUSH

Keebush is an acid-resisting constructional material used for the construction of tanks, pumps, pipes, valves, fans, etc. It is completely inert to most commercial acids; is unaffected by temperatures up to 130°C; possesses a relatively high mechanical strength, and is unaffected by thermal shock. It is being used in most industries where acids are also being used. Write for particulars to—

KESTNER'S
5 Grosvenor Gardens, London, S.W.1

PIPERIDINE
COMMERCIAL
PYRIDINE FREE
LUPETIDINE

FULL DETAILS FROM ACTUAL MANUFACTURERS

ROBINSON BROTHERS LTD
CHEMICAL MANUFACTURERS
RYDERS GREEN · WEST BROMWICH
Tel: West Bromwich 0080
HEAD OFFICE: OLDBURY · BIRMINGHAM

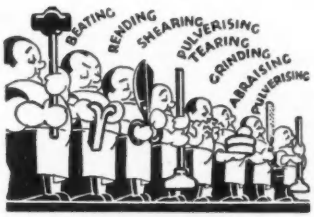
Filter Crucibles of Porous Porcelain

retain the finest precipitates and filter rapidly. They are not affected by acids, remain constant in weight within very fine limits and can be heated to high temperatures.

Made by
The **WORCESTER ROYAL PORCELAIN CO. LTD.**
and
Supplied by all recognised Laboratory Furnishers

JUDACTAN
ANALYTICAL REAGENTS WITH ACTUAL BATCH ANALYSIS

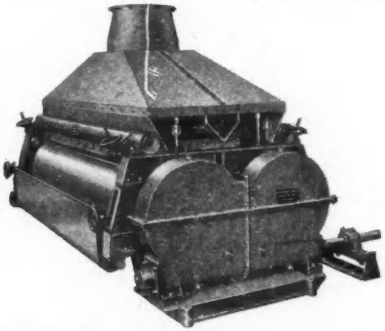
THE PULMAC MILL



FOR REDUCING CHEMICALS TO THE FINEST POWDER or GRANULATION MADE IN FOUR SIZES

INTERNATIONAL PULVERISERS Ltd.
70, VICTORIA ST., LONDON, S.W.1.
Telephone—Victoria 2958.
Telegrams—Pulgrind, Sowest, London.

MULTITUBULAR DRIERS
ROLLER FILM DRIERS
FLAKERS AND COOLERS



We offer accumulated experience of 50 years' specialization.

OUR WORKS, the largest in the United Kingdom devoted especially to DRYING MACHINERY, are laid out and equipped with the latest plant for this particular purpose.

MANY STANDARD SIZES including LABORATORY MODELS.

We have test plants always available

RICHARD SIMON & SONS, LTD.
PHŒNIX WORKS, BASFORD, NOTTINGHAM

"STILL LEADING"

For CHEMICAL & ALLIED TRADES

ACID RESISTING CEMENTS & LININGS

For PICKLING TANKS, FLOORS, DIGESTERS, KIERS, STONE, CONCRETE, BRICK, WOOD, IRON VESSELS & ACID TOWERS

PICKLING TANKS 60 FEET LONG WORKING SUCCESSFULLY

RIZISTAL

AN ALL BRITISH PRODUCT

RIZISTAL TRADE MARK

RESISTS

Formaldehyde, Alcohol, Oils, Greases and Tar Acids, Benzene Toluene Compounds HCl, H_2SO_4, HNO_3, and H_3PO_4 mixed HNO_3 and HF Acids, Aqua Regia, Formic, Acetic, Lactic Oxalic, Chromic Acids, Bisulphites, Hypochlorites, Mixed Acids, Peroxides, Nascent Halogens and Alkalies.

UNDER STEAM PRESSURES

SOLE MAKER *OVER 50 YEARS' EXPERIENCE*

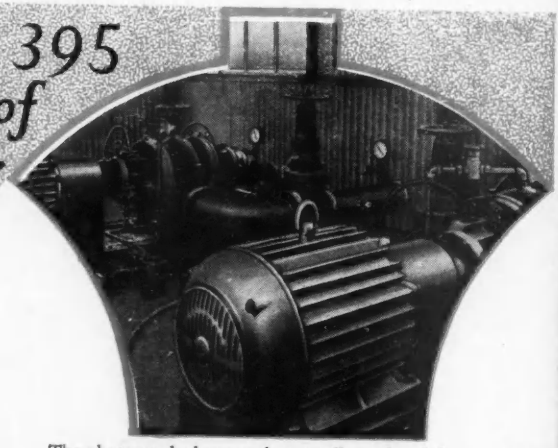
JOHN L. LORD

WELLINGTON CEMENT WORKS

TELEGRAMS: "CEMENT" PHONE: BURY 617

BURY, LANCASHIRE

One of 395 flameproof motors for Stanlow



The photograph shows 15 h.p. totally-enclosed flameproof motors driving Sigmund pumps at the Shell Chemical plant where 195 M-V motors are installed; 200 more are being supplied to the Shell Oil refinery nearby.

The various types of motors used are covered by Buxton flameproof certificates and bear the FLP mark.

Member of the A.E.I. group of companies

METROPOLITAN-VICKERS ELECTRICAL CO. LTD., MANCHESTER 17

Printed in Great Britain by THE PRESS AT COOMBELANDS, Ltd., Addlestone, and published by BENN BROTHERS LTD., at Bouverie House, 154, Fleet Street, E.C.4, 16 June, 1951. Registered at the General Post Office. Entered as Second Class Matter at the New York U.S.A., Post Office.

1951

roof
ical
are

ton

ESTER 17

OTHERS
Office.